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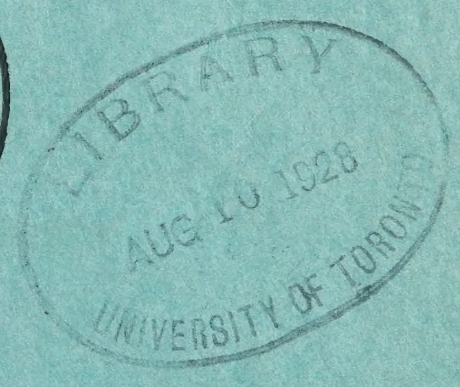


DEPARTMENT OF THE INTERIOR
Hon. Charles Stewart, *Minister* W. W. Cory, C.M.G., *Deputy Minister*
NORTH WEST TERRITORIES AND YUKON BRANCH
O. S. Finnie, *Director*

CANADA NORTH OF FIFTY-SIX DEGREES

THE LAND OF LONG
SUMMER DAYS

BY
E. M. KINDLE



Ottawa
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1928

Canada. Northwest Territories and Yukon
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CANADA NORTH OF FIFTY-SIX DEGREES

THE LAND OF LONG
SUMMER DAYS


BY

E. M. KINDLE

GEOLOGICAL SURVEY
DEPARTMENT OF MINES
OTTAWA



THE OTTAWA FIELD-NATURALISTS' CLUB
OTTAWA, CANADA



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P R E F A C E

THE VIVID word pictures and typical photographic glimpses from the facile pen and handy camera of Dr. Kindle of the Geological Survey of Canada, Department of Mines, included herewith, are well worth study by any one interested in our rapidly developing Dominion.

In recent months many men of wide vision in different countries, attempting to come to some conclusion as to just what parts of the world are likely to make the most striking progress in the next few decades, have very commonly fixed on Canada as the one country certain to witness very great development within her boundaries in the near future, and to judge by developments in the past few years that part of our country North of 56° is likely to be well to the front, if not in the lead, in the coming era of expansion and prosperity.

The North West Territories and Yukon Branch of The Department of The Interior, appreciative of the economic possibilities of this great Northland, has thought it worth while to give Dr. Kindle's informative article some measure of the publicity which it would seem to merit.

The possibilities of development in this great and largely unknown domain seem unlimited—live stock, forage crops, grain growing, fur farming, lumbering, pulp manufacturing, mining, fishing and hunting are just a few of the lines that open up.

It is for the man of vision to decide just what line his particular effort will take in this great Northland—any man's land.

CHARLES STEWART,

Minister of The Interior.

EXPLANATION OF HALF-TONE ILLUSTRATIONS




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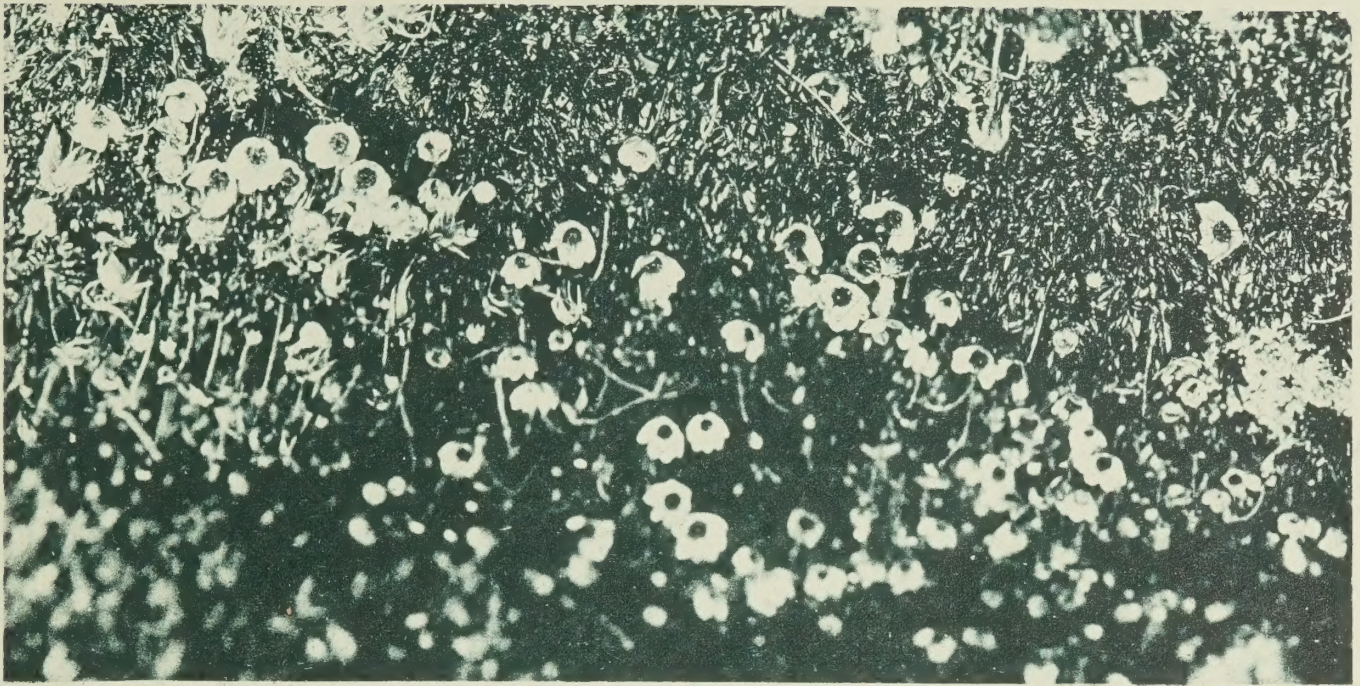
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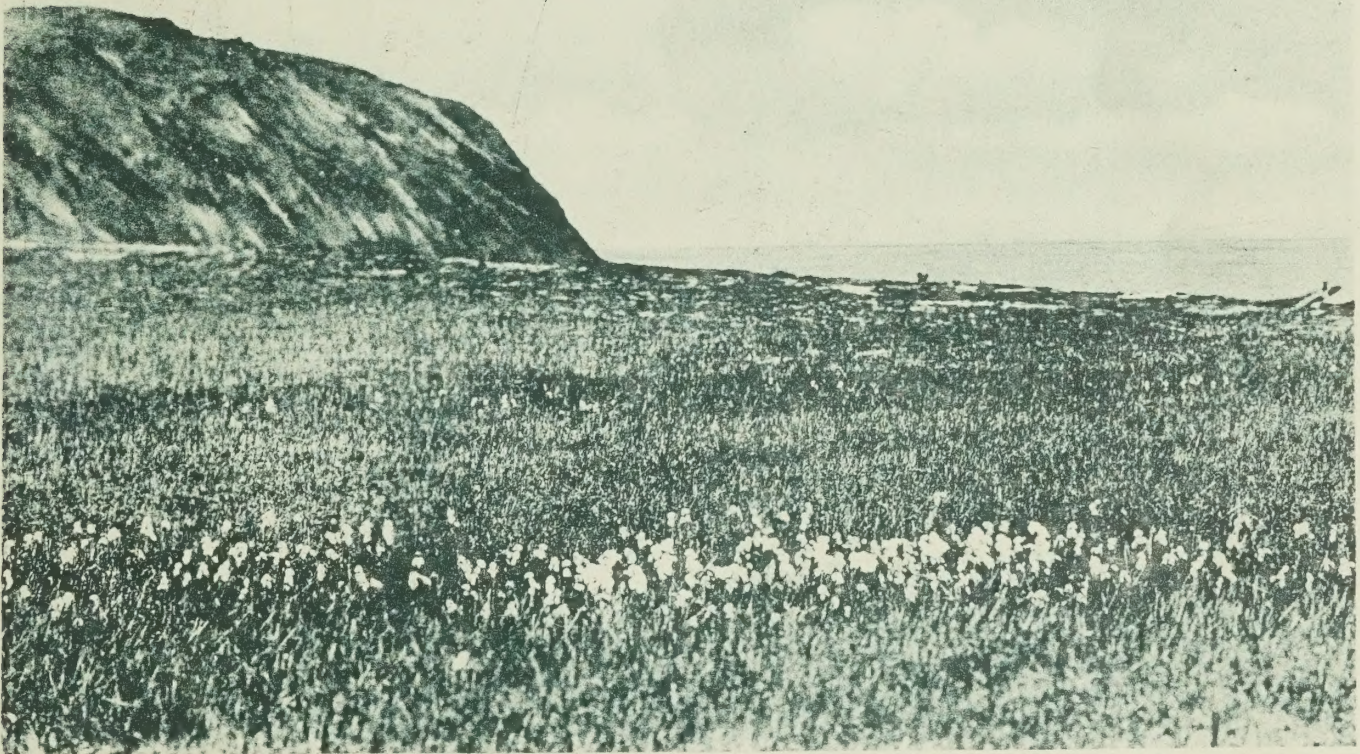
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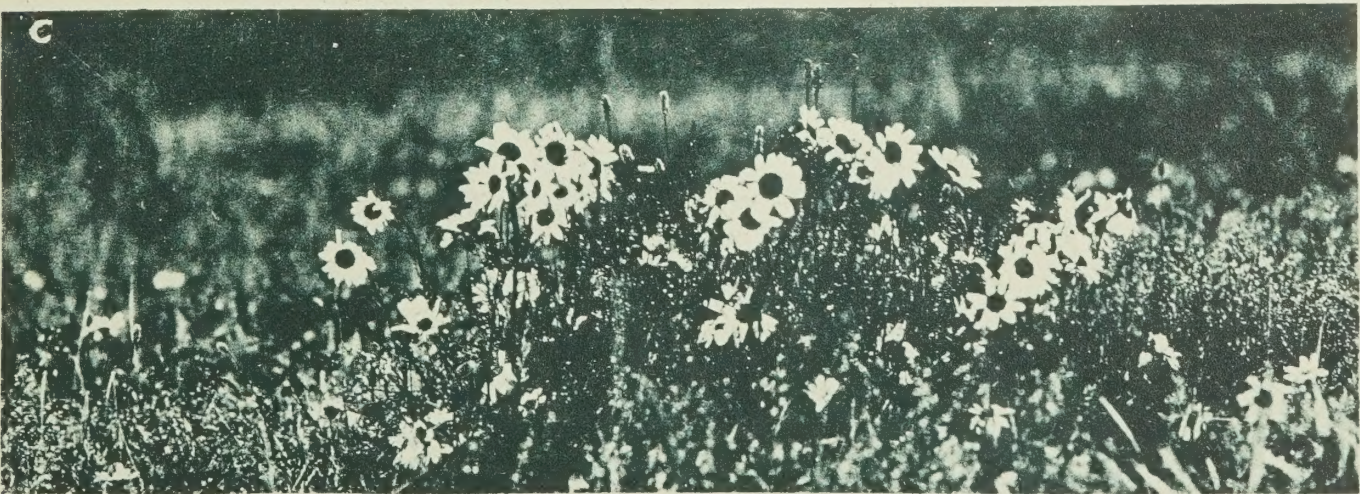


FIG. 1. (*Frontispiece*)—FLOWERS OF THE ARCTIC COAST.

A. *Dryas octapetala*, BERNARD HARBOUR, July 3 (top).

B. COTTON PLANT, HERSCHEL ISLAND (middle)

C. DAISIES, HERSCHEL ISLAND.



FIG. 2.—MAP OF CANADA.

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CANADA NORTH OF FIFTY-SIX DEGREES*

The Land of Long Summer Days

By E. M. KINDLE

Geological Survey of Canada

NORTHERN LANDS have in the past been held in small esteem by the general public. A somewhat comparable failure to appreciate mountain scenery during the Middle Ages and earlier led men to avoid the Alps and other mountain regions of Europe which later became the playground of that continent and much of the rest of the world. The deep-rooted prejudice against Arctic and sub-Arctic lands enabled a few far-sighted Americans to acquire for the United States some sixty years ago the vast territory of Alaska for a sum less than the value of ten years' output of the Nome Beach gold field discovered twenty-five years later. In Europe, however, the old view that lands of the Far North are worthless is rapidly passing. Evidence of this is seen in the fact that Norway has acquired sovereignty over the large Arctic island of Spitzbergen and is developing its rich coal deposits and fisheries. The eastern coast of Greenland may be called fairly the most inhospitable land in the northern hemisphere. Only very skilful navigators can penetrate through the ice fields to the coast in midsummer; yet the ownership of this frigid coast, with its ice cap on land and nearly impenetrable floes on the sea, has recently been the subject of a long and rather bitter controversy between the Norwegian and Danish governments. A colony of west-coast Greenlanders has lately been successfully established by Denmark on the ice blocked east coast of Greenland.

The region which is here discussed has no precise boundary, but it may be defined in a general way as that part of Canada lying north of the present frontier of settlement. The northern border of this frontier is manifestly a highly irregular line which moves northward under the control of a variety of influences, among which are topographic features, climatic conditions, railway development and the dissipation of erroneous conceptions of northern Canada. The average position of this line in western Canada is near the 56th parallel of latitude. (Fig. 2.)

Northern Canada was long regarded as a fit abode only for fur traders and Eskimo. The fur trade was considered its only asset until some thirty years ago when the Klondike River valley began to pour out its flood of gold. The Klondike placers, during the first seven years of their development, produced gold to the value of more than \$100,000,000. The discovery since the early Klondike days of various other notable but less spectacular Eldorados near the northern frontier has led Canadians to revise their earlier valuation of their vast unoccupied and almost unknown heritage in the great Northwest. But the opinion still widely prevails that northern Canada is a desolate barren land of snow and ice which has little to tempt anyone except the prospector and the trapper.

The man who always searches for the worm in the apple, while granting that the prospector, miner or fur trader may be willing to spend a few years in northern Canada in the hope of winning a fortune, will deny that any highly developed social organization or large population can ever be expected in a land almost deserted by the sun in winter and which lies hundreds of miles north of such population centres as Winnipeg and Edmonton,—where the temperature falls about as low as the ordinary man cares to endure.

It must of course be admitted that the winter evenings are long and the hours of daylight few in winter north of lat. 56°, and any inquiry into the resources of northern Canada may well begin with a consideration of this oft cited bar to their

*In a Canada-wide competition organized by the late Sir William Price for the best essay on "The Geography and Resources of Canada, north of 56 degrees," this paper won the prize of \$1,000. It is now adequately illustrated, partly through the generosity of Mr. J. H. Price and the heirs of the Price Estate. Most of the illustrations used are from photographs by the Geological Survey of Canada which the author has been permitted to use through the courtesy of the Director. A map showing the recently established Labrador Boundary is included by the courtesy of the *Geographical Review*, published by the American Geographical Society of New York. The author is also indebted to the Director of the Dominion Experimental Farm, J. Hornby, R. A. Brook and Capt. Mills for the use of photographs, and to Mr. O. S. Finnie and the *Dearborn Independent* for the loan of plates.

development. The superb health and vigour of the northern Eskimo afford conclusive evidence that the long winter nights have no harmful effects. The Eskimo look forward to the dark midwinter period as a time for long visits to friends, and spend it in singing, dancing and social pleasures (Fig. 3). After ten winters in the Arctic, Stefansson reports the darkness of Christmas to be "about as depressing on the northern coast of Canada as the darkness of midnight on Broadway."

Each party puts forth its best actors, and strives in every way to outdo the other. During the first day, when the comic dances are on, the tribe succeeding in making the other laugh can demand anything they wish. The best dancers receive valuable presents. . . ."

"As each man entered he threw down a small gift before the *naskut*, as is customary on such occasions. As soon as everyone was settled, the dances began. Strange noises were heard in the tunnel, gradually approaching the room.

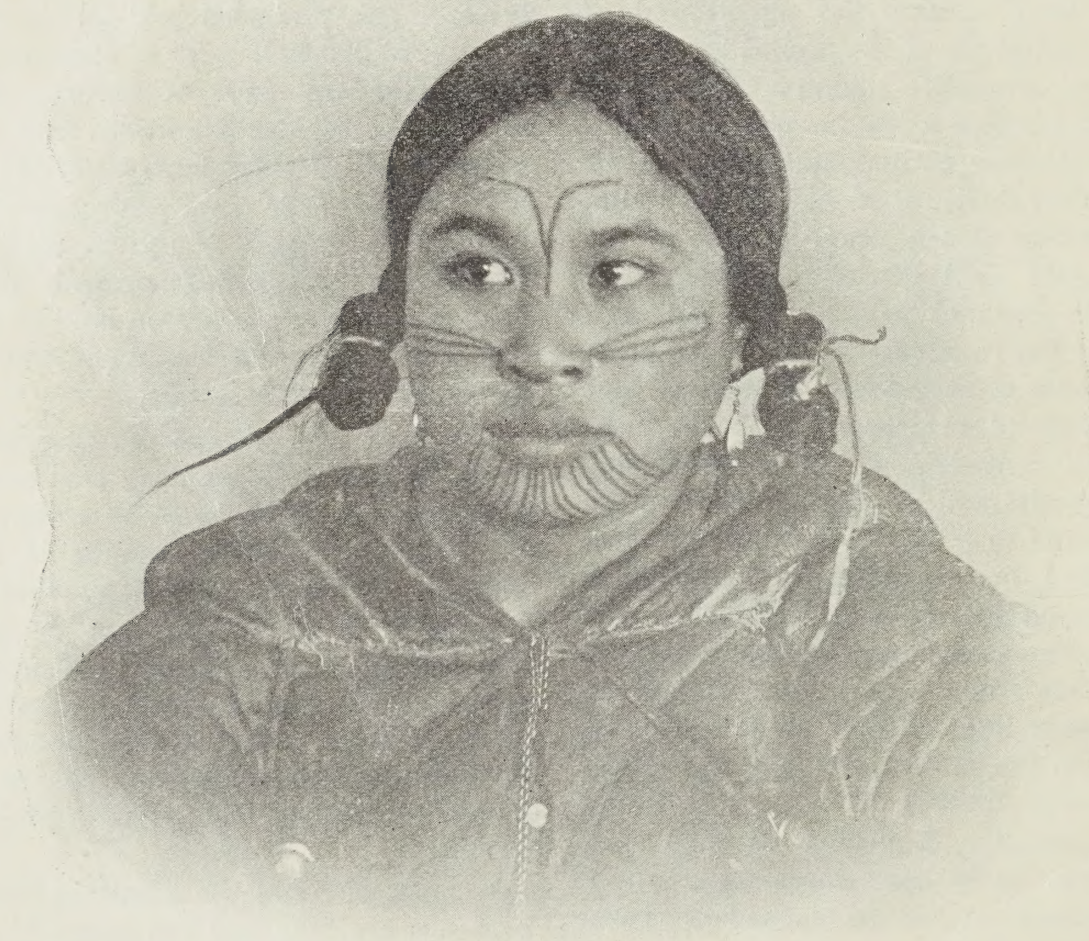


Fig. 3

There are few vaudeville shows which would not be outclassed in comic and novel features by some of the Eskimo dances of the Arctic coast. The following extracts from Hawkes¹ account of these dances will give some idea of the jolly life which the natives lead in the winter season.

"The 'Inviting-In' dances partake somewhat of the nature of the nith contests of Greenland.

Then a horrible looking wooden face was thrust up through the entrance hole, worn by the chief comic dancer of the Unalit. . . ." (Fig. 4.)

"A young woman appeared in the centre of the floor wearing a white reindeer parka and a girdle of reindeer hair tied around her waist. She began the conventional motions of the woman's dance, glancing nervously around her. Then men dancers, wearing fillets and armlets

¹. Can. Geol. Surv. Mem. 45, 1913, pp. 12-15.



FIG. 5. PROSPECTOR TRACKING UP A NORTHERN STREAM WITH DOGS.



FIG. 8. A. INDIAN CANOE ON LAKE MISTASSINI, LABRADOR.
 B. LAKE MELVILLE, LABRADOR. Geological Survey of Canada, launch in foreground.

of wolfskin, leaped upon the *inlak* and surrounded her, jumping about and howling hideously. As the dance-song quickened, they became more and more excited, until the floor became one confused mass of shaggy heads and wildly tossing arms. The drums re-

tudes. The sub-Arctic island, Iceland, gives decisive evidence on this point. The history of the Icelanders clearly shows that the long winter nights have just the opposite effect and by giving people ample time for study and reflection greatly stimulate the intellectual life. Some of the old



Fig. 4

doubled the beat, until the *kazgi* fairly rocked under the volume of sound and the stamping feet. Then as suddenly as the pandemonium began, it ended. This was easily guessed as the wolf-pack pulling down a reindeer."

It might be claimed, however, in spite of the gay winter life of the Eskimo, that the long dark winter evenings would lead to mental stagnation in any white race which dwelt long in high lati-

Icelandic sagas, written centuries before the days of Chaucer, are models of style. Many of these remarkable literary productions were written when much of Europe was in the deepest barbarism and ignorance. It is reported on good authority that during the last hundred years no nation can show so large a proportion of literary men as Iceland. If we can judge from the record of Iceland for the last thousand years nothing

more serious need be feared from the effect of an Arctic environment on a people than the development of an uncommonly large percentage of poets.

The climate of northern Canada from some points of view is one of its greatest assets. The winter temperature in Arctic and sub-Arctic Canada will always discourage the immigration of the negro and other tropical races as unmistakably as it does the growth of bananas. It will, on the other hand, encourage the immigration of the Nordic races of Europe and raise the deterring hand to the leisure-loving races, whose motto is *Manana* (to-morrow). Canadian climate thus automatically selects the class of immigrants which the United States has recently attempted to secure by discriminative legislation.

Anyone with an intimate knowledge of climatic conditions in northern Canada is aware that its reputed severity has been—as Mark Twain once said of his reported death—greatly exaggerated. The popular misconceptions are so deeply rooted that it will require decades of education to eradicate them. It is almost universally believed by those who have made no special investigation of the matter that winter climate increases steadily in severity as the North Pole is approached, and that the Pole itself is coincident with the pole of greatest cold. This is about as far from the truth as would be the assumption that the rainfall of any region is proportionate to its distance from the sea coast, and rather recently has been shown to be as erroneous as the early idea that the magnetic and geographic poles were identical. Even as far back as the fifties of the last century, when Dove's charts of the isotherms for the northern hemisphere were published, it became evident that the North Pole and the pole of maximum cold were probably separated by a considerable distance.

It was observed long ago at Kola in Lapland that a north wind always caused an immediate rise in temperature. Baron F. P. Wrangel records that at his winter quarters at Nishne Kolymsk the temperature rose in winter with north winds. Dr. Kane noted the same fact at Rensselaer Harbour in Kane Basin, North Greenland. The most interesting feature connected with Captain W. E. Parry's temperature observations in the Arctic archipelago is the reported rise of temperature with a north wind.¹ The temperature records of Captain Parry,² who wintered at Melville island a century ago, show the lowest temperature reached to have been 55° below zero,

while northeastern Montana is credited with a minimum temperature of -68°.

Facts of this kind do not appear so surprising since it has become known that the cold pole of the world is located at Verkhoyansk, Siberia³, about 1,400 miles south of the North Pole, where the mean winter temperature is -48° in January. It is interesting to note that even at this coldest point in the world barley sometimes ripens and vegetables are grown in a small way⁴. To Canadians, the most interesting and satisfactory feature of this latest information concerning the pole of maximum cold is the fact that it is located neither in Canada nor at the geographical pole, but in Siberia. After the school geographies have had time to assimilate and broadcast this information, the popular mind will be prepared to look upon the future development of northern Canada from a new point of view.

A clear perception of the fact that latitude is a factor, but often the least important one, in controlling temperature is fundamental to any adequate evaluation of the potential resources of Arctic Canada. The following data derived from authentic sources should make this perfectly clear. The minimum temperature at Bernard Harbour, Arctic coast of Canada in Lat. 68°24' N. for the winter of 1915-16 was -46°⁵, or two degrees milder than the temperature at Fort Simpson, 550 miles to the south of Bernard Harbour. This Bernard Harbour minimum temperature is only one degree colder than the lowest temperature recorded for New England during a 30-year period preceding 1918 and the same as the lowest temperature observed in northern New York for the same period⁶. The comparison of Arctic coast temperature records with those from the interior of Arctic America makes evident the relatively mild character of the winter climate of the coast. The lowest temperature recorded at Point Barrow, Arctic coast of Alaska, during a period of 5 years was -50° whereas a temperature of -76° has been observed at Fort Yukon, 340 miles farther south, where the temperature mean for the entire month of December, 1917, was nearly 49° below zero⁷. The minimum temperatures⁸ recorded for the year 1900 at Herschel

³. Danckwortt, P. W.—Siberien und seine wirtschaftliche Zukunft: Ein Rückblick und Ausblick auf Handel und Industrie Sibiriens (1921), *Geogr. Review*, vol. 13, p. 314, 1923.

⁴. Zenzinov, Vladimir M. With an Exile in Arctic Siberia: *National Geographic Magazine*, vol. XLVI, p. 701, Dec. 1924.

⁵. Johansen, F.; Vegetation along the Arctic Coast between Point Barrow and Bathurst Inlet: *Can. Arctic Exped.*, Rept., vol. V, Pt. C (MS)..

Anderson, R. M.—Recent Explorations on the Canadian Arctic Coast: *Amer. Geog. Rev.*, vol. 4, p. 258, 1917.

⁶. Memo. from the U.S. Weather Bureau.

⁷. Memo. from the U.S. Weather Bureau.

⁸. Preble, E. A.—North American Fauna, No. 27, p. 35, 1908.

¹. Three voyages for the Discovery of a Northwest Passage from the Atlantic to the Pacific and narrative of an attempt to reach the North Pole. Vol. 1, p. 147.

². *Op cit.*, vol. 1, p. 169.



FIG. 12. A. TRAPPER'S CABIN, PEACE RIVER.

B. NAHANNI BUTTE IN THE FRONT RANGE OF THE ROCKY MOUNTAINS,
NEAR JUNCTION OF NAHANNI AND LIARD RIVERS.

C. INDIAN CABIN WITH SPRUCE-BARK ROOF, RESOLUTION, GREAT SLAVE
LAKE.

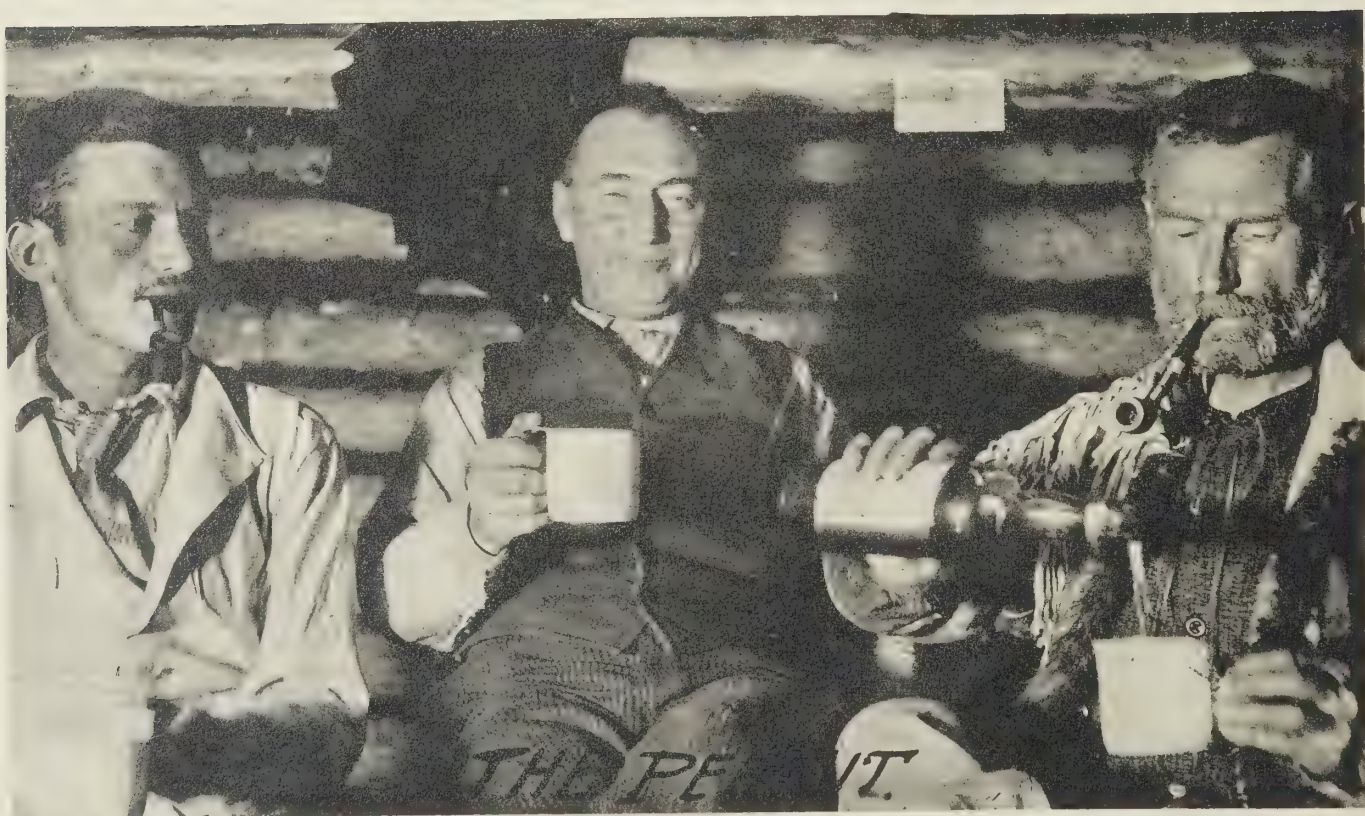
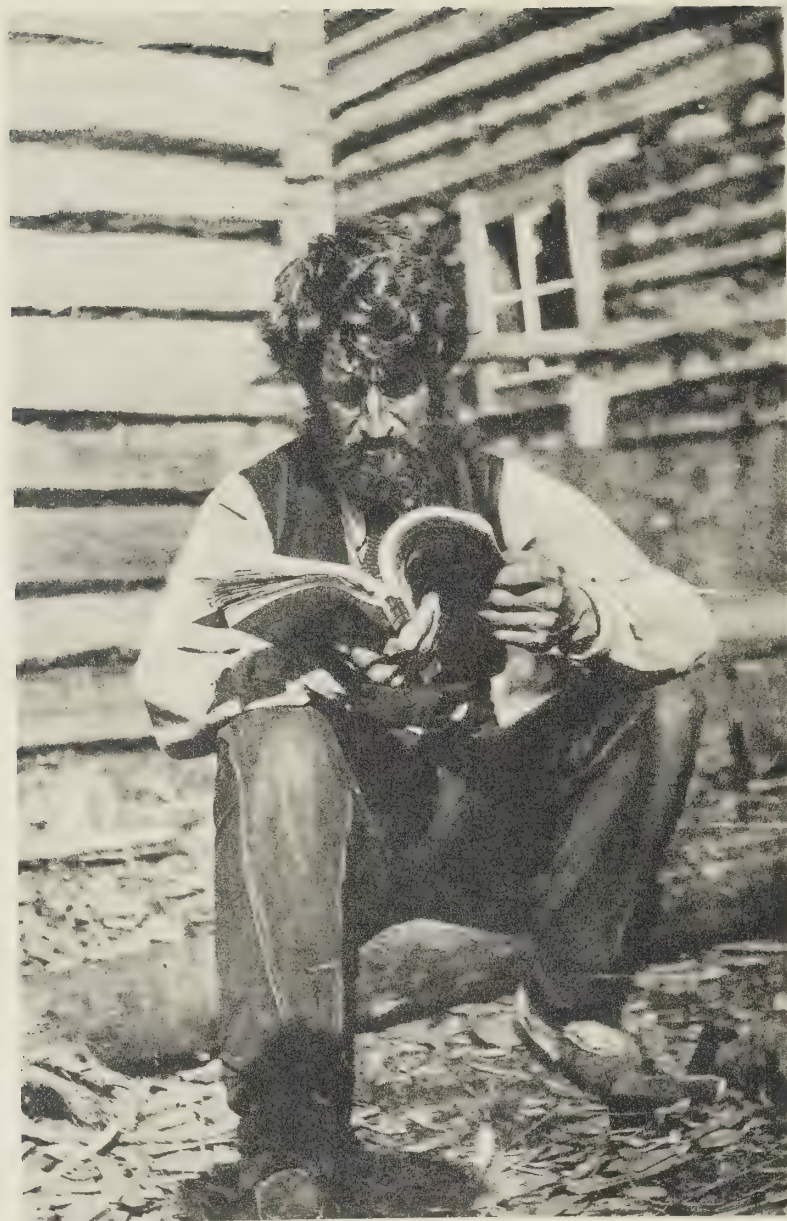


FIG. 13. OUTSIDE AND INSIDE VIEWS OF A MACKENZIE RIVER CABIN.

island at the mouth of the Mackenzie, McPherson 130 miles, and Good Hope 270 miles south of Herschel, were respectively -49.4° , -60° , and -62° , increasing in severity, it will be noted, from north to south as in the comparison between Point Barrow and Fort Yukon in Alaska.

Colorado claims to have a lake near the 40th parallel some 600 miles south of the Canadian border which is free of ice only one month in the year¹. South Dakota has a minimum temperature record of 50° below zero². The important fact to remember however in connection with the -50° temperatures of South Dakota and Northern Canada, is that all continental climates run to extremes. With a record of 50° below, South Dakota can some years indulge in tennis at Christmas, and the towns of sub-Arctic Canada and Alaska enjoy every winter the sport of dog races which sometimes cover a 300 or 400-mile course.

The summer climate of northern Canada is apt to surprise even well informed travellers who cross the Arctic Circle via the Mackenzie river for the first time. This is well illustrated by the testimony of Mr. Elihu Stewart, formerly Superintendent of Forestry for Canada, in his book *Down the Mackenzie and Up the Yukon*. "We had counted on escaping the usual July heat," Mr. Stewart writes, "but for the greater part it had really been more oppressive and certainly more constant, extending right through the long twenty-four hour day, than I had ever before experienced." Another author speaking of his experience northeast of Great Bear lake writes that all of his party agreed "We had never in our experience suffered as much from cold as we suffered from heat that summer." Ample confirmation of the impressions which the traveller in the North gets of the summer climate is furnished by the Weather Bureau records at Fort Yukon, just at the Arctic Circle, where temperatures above 90° in the shade are recorded nearly every summer. In the accompanying photograph of a prospector "tracking up a northern river" the panting dogs speak more eloquently than the Weather Bureau figures of the summer climate of the North (Fig. 5).

Even in the old Eskimo legends we find allusions to the summer heat. A legend concerning the contemporaneity of the mammoth and the Eskimo illustrates one method of escaping the heat resorted to by the natives. According to this old tradition, as recorded by Dr. Driggs,³

a hunter finding the weather extremely warm "sought the shelter of a cave, intending to await the passing of the heat of the day. He had not been long in the shelter before the sound of a heavy animal passing rapidly over the earth greeted his ears, and on looking out he saw a mammoth in full flight, the huge creature exhibiting great fear as it was being chased by a thin short-haired wolf."

The "frozen north" has for a number of years been retreating northwards. Like the "great American desert" which constituted the major portion of the United States west of the Mississippi river, according to the geographies of sixty years ago, the "frozen north" is destined to shrink to very small proportions.

From this general discussion of the misconceptions which have hindered or delayed recognition and development of the resources of Arctic Canada we may pass to a consideration of some of the larger natural geographical divisions of the great Northland.

LABRADOR PENINSULA

EARLY EXPLORATION AND SETTLEMENT.—Labrador peninsula has the paradoxical distinction of being the first discovered and the least known part of North America. Since its bleak shores were visited by the Norseman, Bjarne Herjulfson, in 986, and by Lief, son of Eric the Red, in 1000, Labrador has attracted only a few thousand fishermen. The flood of emigration from the Old World has flowed to the south and left this great Northland untouched save by the fishermen, who occupy during the summer widely scattered sites along the eastern coast. The reason for this neglect lies in the fact that the sea bordering Labrador on the east is the great highway by which the ice from much of Arctic America and western Greenland travels southward in summer under the influence of an Arctic current. This current keeps vast ice fields moving down the coast till late in the season, and gives to even the southern parts of "the Labrador" a polar climate in mid-summer.

The English navigator, John Cabot, who re-discovered Labrador in 1497, returned with glowing accounts of the abundance of the cod fish there. English, French, Spanish and Portuguese fishermen soon verified and utilized the immensely rich fisheries discovered by the Cabots. These have been continuously exploited down to the present.

Jacques Cartier and Martin Frobisher were among the early navigators who visited the coast of Labrador. Cartier stated that there was "not one cartload of earth on the whole of it".

¹. Robert S. Yard. *Glimpses of our National Parks*, Dept. of Interior, Washington, p. 10, 1916.

². Freenian Ward. *Geogr. Review*, April, 1927, p. 245.

³. Driggs, John B.—*Short Sketches from Oldest America*: Geo. B. Jacobs & Co., Phila., 1905, pl 83.

He added, however, that “if the land were as good as its harbours it would be a good country.”
The Hudson’s Bay Company began in 1827 to

Labrador, crossing from Ungava bay to Hamilton inlet and discovering the Grand falls of the Hamilton river.

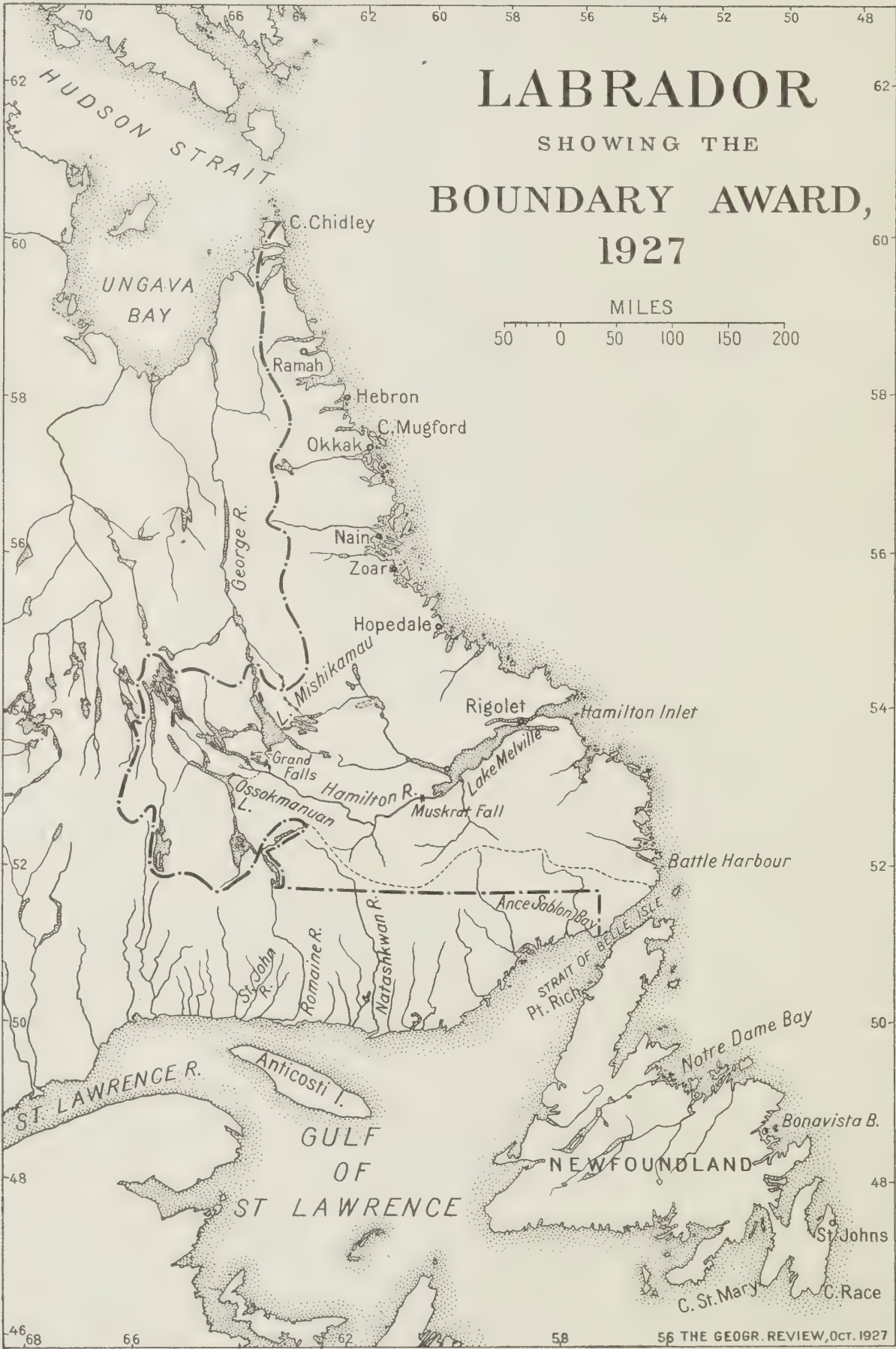


Fig. 6

establish trading posts in Labrador. Their first post at Rigolet was opened about 1837. John McLean¹, an agent of the Company, made in the years 1838 and 1839 extensive journeys in

Our knowledge of the geology of the interior of Labrador dates from Low’s work in the early

¹ McLean, John.—Notes of a Twenty-five Years’ Service, in the Hudson’s Bay Territory, vol. II, p. 116, 1849.

nineties. His report¹ is the only one which deals with the Labrador peninsula as a whole, and it represents by far the most valuable scientific work which has been done in the interior.

Mrs. Leonidas Hubbard² is one of the notable later contributors to the geography of eastern

river to Ungava bay, and published a map of the waterways traversed.

LABRADOR BOUNDARY.—All the coast of which Cartier spoke in such uncomplimentary terms and much besides was given to Newfoundland by the terms of the recent Boundary decision

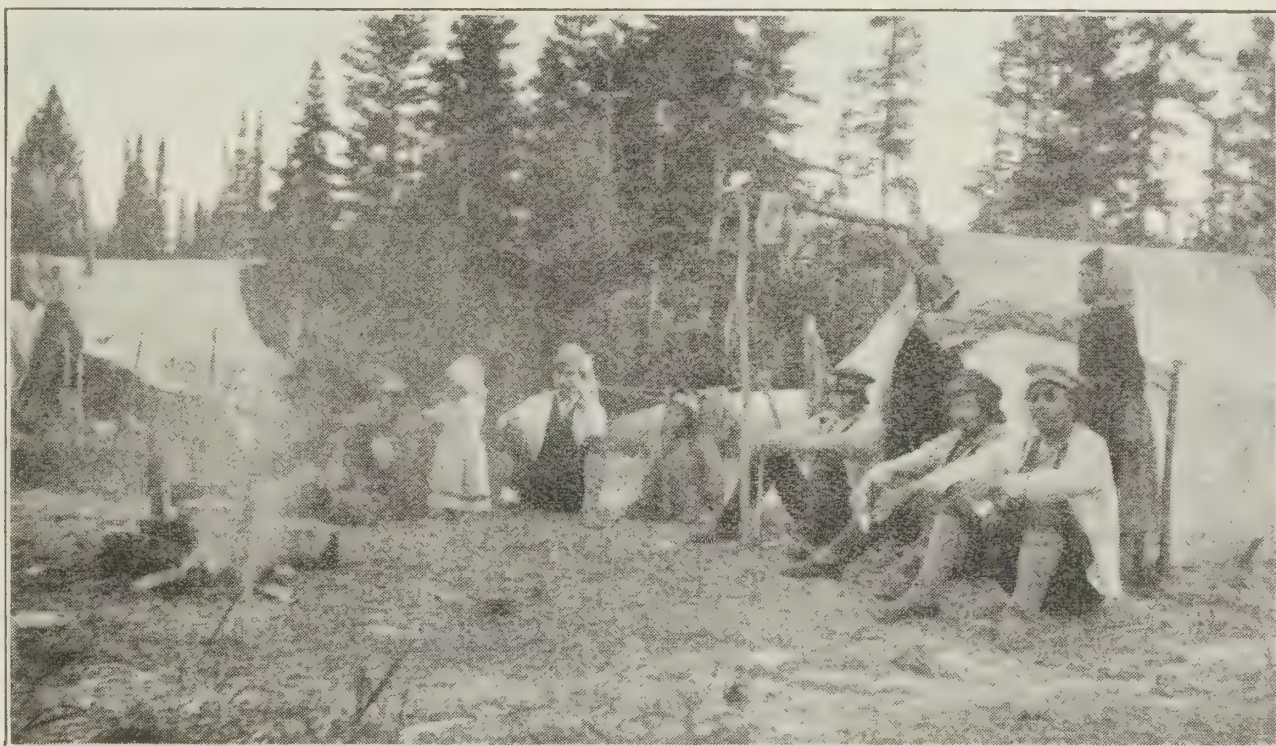


Fig. 7A



Fig. 7B

Labrador. She traversed Lake Melville and Grand lake, the Naskaupi river and the George

The settlement of the Boundary dispute assigns to Newfoundland Labrador the whole of the

¹. Low, A. P.—Report on Explorations in the Labrador Peninsula. Can. Geol. Surv. vol. VIII, 1895-1897.

². Labrador from Lake Melville to Ungava Bay: Amer. Geog. Soc. Bull., vol. 38, pp. 529-539.

Hamilton River basin and the eastern side of the George river. This leaves Canada a vast and little known area including all of the peninsula which drains into Hudson bay. The boundary line separating Newfoundland Labrador from Canadian Labrador is shown in the map, figure 6.

THE PEOPLE.—A Frenchman of parts, who had chosen the bleak coast of Labrador for a home, once described it in explanation of his choice as "a country with no fees, no lawyers and no taxes." This terse description, though written a century ago, still fits the country. Although located in the same latitude as the British Isles and having more than twice their area, the Labrador peninsula has a total permanent population less than that of a small Ontario city.

The people of Labrador peninsula belong to four groups: the Newfoundland fishermen, who spend only the summer on the eastern coastal strip belonging to Newfoundland, which is known as "The Labrador"; the Eskimo; the Indians, and the "liveyeres" or half-breeds. It is the cod fisherman from Newfoundland and his picturesque shack, always located on the shore, that first catch the eye of the visitor from the south. One of the largest groups of these fishermen is located at Indian Harbour, a centre of the cod fishing industry. Salmon fishing, which is, after cod fishing, the most important occupation of the east coast, is carried on chiefly by the "liveyeres" about the mouths of the rivers in the waters of Lake Melville and in the fiords farther north.

Labrador was divided originally between the Indian and the Eskimo, the former holding the interior, the latter the coastal strip. The Eskimo are now nearly extinct in the Hamilton Inlet region and southward. The territory formerly held by the Eskimo was approximately the same narrow shore zone now occupied by the Newfoundland and French-Canadian fishermen, but all the vast interior river and lake region belonged to the Indian. When the white man first came to the Gulf of St. Lawrence, the Eskimo held the narrow coast strip as far west as Mingan opposite the western part of Anticosti island. The acquisition of firearms from the French enabled the Indians in 1600 to drive the Eskimo eastward to the Strait of Belle Isle. Since then the Eskimo has retreated very slowly to his present southern limit at Hamilton inlet. From this point northward the widely spaced groups of Eskimo still occupy the coast and extend westward along the shore of Hudson strait and southward along the eastern side of Hudson bay as far as Cape Jones. South of this point the few native inhabitants on the coast are Indians.

The Indians of the eastern part of the Labra-

dor peninsula belong to two distinct tribes—the Montagnais of the south, and the Naskaupis of the north. The Hamilton river and Lake Melville form in a general way the boundary between the hunting grounds of these two Indian groups (Fig. 7).

According to the estimate of the Dominion Department of Indian Affairs, the total number of Montagnais Indians who came to the southern coast of Labrador in 1908 was 694. All these with the exception of the few too decrepit to travel, spend the greater part of the year in the interior. The summer journeys in search of caribou and other game often take them a very considerable distance along the rivers and lakes. All of them make a spring or summer trip to the coast where they dispose of the winter's catch of fur and secure supplies from the traders.

The Naskaupis, who occupy the George River basin to the north of the Montagnais territory, show less inclination to visit the trading posts than the Montagnais. McLean said of them that "of all the Indians I have seen, the Naskaupis seem most averse to locomotion; many of them grow up to man's estate without once visiting a trading post.¹" They now come to the coast to trade at two or more points.

In the old days when the time-honoured boundary between Indians and Eskimo was overstepped by either race, savage reprisals resulted. Battle Harbour is one of the names which has survived from the days when the Indian and Eskimo tried to revise the inter-racial boundary with the tomahawk and the spear. The Indian still lives as his ancestors did, except that canvas canoes and tents have supplanted the birch bark canoe and the skin-covered tepee.

CLIMATE.—The coastal strip and the interior of Labrador present a surprising climatic contrast. This is due chiefly to the influence of the Labrador current, which carries a stream of floating ice and bergs southward along the entire eastern coast of Labrador. Throughout the most of July the vast ice fields move steadily southward, giving rise to a sub-Arctic temperature over the western side of Davis bay and the adjacent coast, as far south as the Strait of Belle Isle. The ice-chilled narrow coastal zone of islands and sea-facing mainland, called "The Labrador" by the cod-fisher, is practically treeless. Only a short distance inland, however, this gauntness gives place to the heavy forestation of the interior valleys where a summer climate replaces the frigidity of the coast and offers the great contrast con-

¹ McLean, John.—Notes of a Twenty-five Years' Service in the Hudson's Bay Territory, p. 119, London 1849.

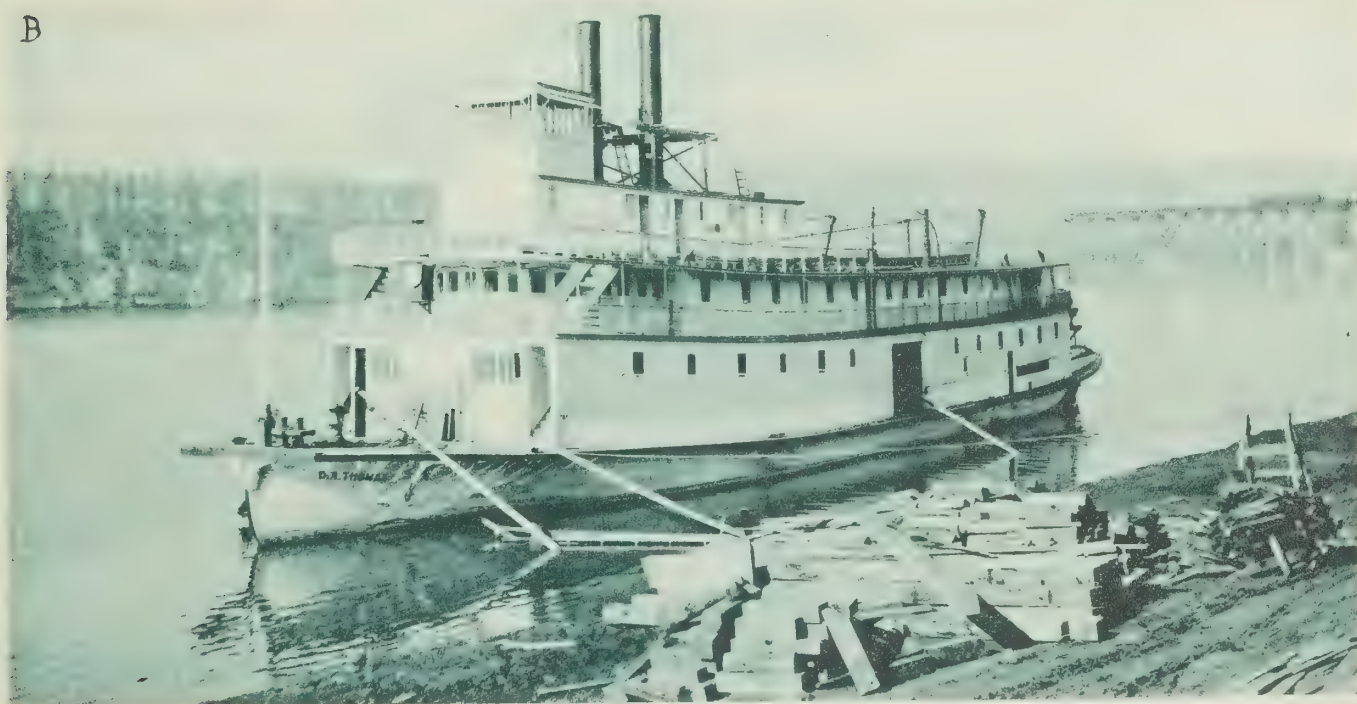


FIG. 14. A. BIRCH-BARK CANOE WITH HUDSON BAY BLANKET SAIL,
MACKENZIE RIVER.

B. S.S. *D. H. Thomas* AT PEACE RIVER CROSSING.

C. SCOW BRIGADE, ATHABASKA RIVER BELOW GRAND RAPIDS.



FIG. 15. A. INDIAN SUMMER CAMP AT SIMPSON, MACKENZIE RIVER.
 B. BIRCH-BARK CANOE UNDER CONSTRUCTION, HAY RIVER, GREAT SLAVE LAKE.
 C. INDIAN FEAST IN FRONT OF ROYAL CANADIAN MOUNTED POLICE HEADQUARTERS AT NORMAN.
 D. HUDSON'S BAY COMPANY RESIDENCE AT FORT GOOD HOPE ON THE LOWER MACKENZIE, NEAR THE ARCTIC CIRCLE.

cisely summed up by Holme¹ in the statement that "a journey of twenty or thirty miles in summer-time up the country from the sea is like passing from winter to summer."

At Rigolet, near latitude 54°, where the temperature is moderated by the open sea, the thermometer has rarely registered 40° below zero in winter. During the summer of 1921, snow was absent from the mountains about Lake Melville during July and August, except for very small patches at elevations above 2000 feet.

Mr. Davies², writing from experience gained by residence at Northwest river, near the head of Lake Melville, states: "The heat, in summer, is often great, though it seldom lasts beyond a single day at a time. I have seen the thermometer as high as eighty-six degrees, at four o'clock p.m., and once, on the 21st August, 1840, it rose as high as ninety-four degrees in the shade." Navigation, according to Davies, is open in Lake Melville about the first or second week in June. "By the latter end of November the Bay is generally frozen over." Grand lake, because of its great depth, "rarely freezes over before the middle of December, nor does it break up till the middle of June."

FORESTS AND VEGETATION.—Black spruce (*Picea mariana*) is the predominant tree throughout the Lake Melville district, but white spruce becomes increasingly common as one proceeds westward or inland. The white birch (*Betula pendula*) is a very common tree, and in tracts which have been burned over it has taken possession of the ground to the exclusion of all other trees. The largest observed specimens of the birch, however, were found sparsely distributed in forests of black and white spruce.

Where the birch constitutes the whole of the forest, its light green foliage distinguishes it at considerable distances from the darker evergreen forests. The forest colour effects vary with the illumination and the distance from the observer. Under a grey sky the black spruce forests appear nearly black in the middle distance, dark green in the foreground, shading off into deep dark blue in the distance. Under a half-clouded sky the forested mountain slopes are marked with blotches of dark blue on a field of light green, the colour scheme changing constantly with the shifting of the clouds. Sometimes at the finish of a

shower a spruce-covered island, rainbow-arched, will furnish a picture not easily forgotten. Labrador has been very appropriately described as the land of rainbows. (Fig. 8B). In many places sphagnum moss into which one sinks to the knees, carpets the ground in a Labrador forest. When this is absent caribou moss often replaces it, and where the trees are not too closely spaced the ash grey of the moss gives a colour contrast to the dark green of the spruce visible at a considerable distance.

These observations on Labrador forests apply to a region in latitude 54° with which the writer is personally acquainted. But the observations of Mrs. Leonidas Hubbard, whose journey extended through Lake Melville and north to Ungava bay, indicate that along the north-south valleys forests continue to show fair-sized trees up to latitude 58° and even beyond. She reports having seen one tree with a circumference of nine feet, and states that "the valley is mostly well wooded with spruce and balsam as far as Mabelle island, and here the spruce reaches splendid size." According to Turner¹ at Fort Chimo, about latitude 58°30' the walls of the buildings are constructed of the larger logs from the local forests, where the trees seldom exceed 10 inches in diameter. On the Whale river trees attain a height of 30 to 50 feet within two miles of Ungava bay.

On the mountain slopes and over much of the plateau region the forests of the river valleys are replaced largely by lichens, emerald green moss and a considerable variety of flowering plants. Trees when not entirely absent are often represented by a variety of Arctic willow, and a dwarfed birch, with branches seldom rising more than two or three inches above the rock crevices that protect their roots. Certain types of upland afford dwarfed spruce not higher than a man's shoulders and others yield trees 15 to 35 feet high.

Away from the valleys in Labrador, mosses, lichens, dwarfed larch, willows and alders quickly replace the forests. Nearly everywhere the white blossom of the Labrador tea is seen during July. As its blossoms fade the dark pink lambskill takes its place, decorating the woods with a profusion of delicate colour throughout the latter part of the summer. About the first of August the half ripe low-bush cranberries begin to show rosy cheeks above the moss and a little later the rich dark purple bearberries and blueberries spread a feast of delicious fruit and ravishing colour on the grey rocky summit of every hill and moun-

¹. Holme, Randle F. A Journey in the Interior of Labrador, July to October, 1887: Proceedings of the Royal Society, vol. X, p. 189, 1888.

². Davies, W. H. A.: Transactions of the Literary and Historical Society, Quebec, pp. 76 and 84, Feb., 1843.

The writer was informed that Grand lake generally freezes over after Christmas and that frost seldom comes in the Grand Lake valley till October.

¹. Turner, L. M.—11th Ann. Rept., Smithsonian Institution, Bureau of Ethnology, p. 173, 1894.

tain. The wild currant, crowberry and baked-apples are among the other refreshments which the hill tops set before their visitors.

MINERALS.—The Labrador peninsula has nearly the area of Alaska and it is in about the stage of exploration and economic development which had been reached by that other great peninsula when Russia sold it to the United States, as a supposedly worthless possession, for seven and a quarter million dollars. But it is not easy for any geologist, who has for a season felt the spell of this vast and very slightly explored land, to avoid suggesting that there are reasons for believing Labrador will eventually contribute to the world's supply of mineral wealth. Neither the fishermen nor the fur traders have ever sought to develop any other wealth in Labrador beyond that furnished by the cod and the pelts. They have, however, given a few hints to the prospector which have thus far remained unheeded.

As early as 1840 a chunk of native copper was found on the shore of Hamilton inlet. Its source remains unknown. The first intimation of the existence of the famous Michigan copper district came from the farmers of the Central States who picked up pieces of native copper in their fields long before the location of their source was known. In the Lake Melville district there are various half-breed trappers (the "liveyerers") who have specimens of chalcocite and other copper ores which they found near trap lines in the interior. Low found extensive deposits of magnetite and other ores of iron at several points in Labrador¹. But thus far little if any attempt to ascertain their commercial possibilities has been made. Very extensive beds of banded iron ores also occur on the Nastapoka islands, which extend along the east side of Hudson bay for a hundred miles north of Little Whale river.² Dr. Bell and Mr. Low record the occurrence of a vein of galena on the west coast of Labrador near Richmond gulf. On the same coast Low found pyrrhotite containing small quantities of nickel.

Professor A. P. Coleman of Toronto University, who has a personal knowledge of north eastern Labrador as well as an intimate knowledge of the mining districts of northern Ontario makes the following significant statement and prediction: "It may be said that the largest area of relatively unexplored territory in this northern hemisphere is to be found in northern Quebec; it consists of Precambrian rocks like those which include the rich mines of gold, silver, iron and

copper of Lake Superior and northern Ontario. The land is almost unoccupied and means of communication are difficult; yet, in the opinion of the writer, the next great development of mining industry is likely to occur in Quebec and spread northward and eastward into Labrador"¹.

The mining engineer may be reminded that while the Labrador coast-line was the first part of North America to be seen by Europeans, most of the interior is still practically an undiscovered country. The use of the aeroplane should soon inaugurate a new era in the exploration of the interior. The thousands of lakes which are scattered throughout the peninsula furnish peculiarly favourable conditions for the use of the hydroplane in Labrador. It is a region where vast areas of bare rock give the prospector exceptional opportunities. It is a country which can be recommended to the prospector who has the skill to combine trapping and prospecting. The men who can do this have the certainty of a living from their traps and fair chance of proving that old Jacques Cartier was slandering the country when he called it the "Land that God gave to Cain."

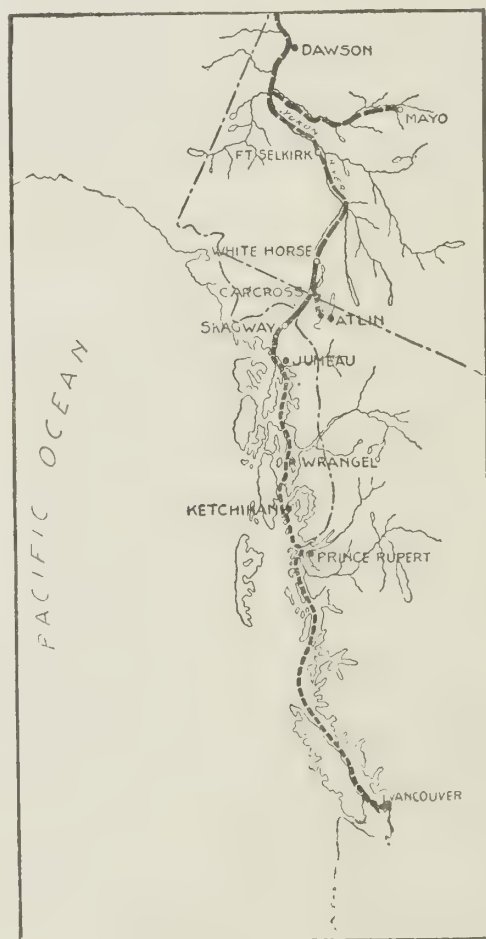


Fig. 9

NORTHWESTERN CANADA

HISTORICAL REVIEW.—Much of the vast region which stretches from Hudson bay to the Alaskan

¹ Low, A. P.: *Op. cit.*

² Low, A. P., *The Cruise of the Neptune*, Gov. of Canada, pp. 239-245, 1906.

¹ Coleman, A. P., *Mining Possibilities in Labrador*, *Can. Mining Journ.*, vol. XLV, p. 870, 1924.

boundary north of latitude 56° is still imperfectly known. Only the larger rivers and lakes have been traversed and charted. Service's brief description is the best that can be given to much of it:

*"There's a land where the mountains are nameless
And the rivers all run God knows where."*

Two of the great river valleys of the continent, the Yukon and the Mackenzie (Figs. 2 and 22,) with the mountain systems adjacent to them, comprise the prominent physical features of the western half of this enormous section of Canada, while the Arctic Prairies, which are sometimes called the Barren Lands, constitute the major portion of the eastern half.

The history of the early exploration of this part of Canada, like most other parts, is closely bound up with the history of the Hudson's Bay Company. The Great Company, as it has often been called, initiated much of the early exploratory work in northwestern Canada. The Northwest Company contributed largely to the exploratory work for a time. The coalition of the two companies in 1821 ended their bitter rivalry in the fur trade. Space does not permit recounting the important Arctic discoveries of such men as Hearne, Dease, Simpson, and Dr. John Rae. The exploration by Alexander Mackenzie of the great river which bears his name was done under the auspices of the Northwest Company. Mackenzie reached the mouth of the river in July 1789, a little more than a month after his departure from Fort Chipewyan on Lake Athabaska, in spite of the predictions of the Indians that old age would overtake him before the consummation of his journey. It was the exploratory work of Mackenzie, Davis, Thompson and others who were connected with the fur trade which prepared the way for the line of far-flung trading posts extending from York Factory and Churchill on Hudson bay to Fort Yukon on the Yukon river.

In the Northwest the Hudson's Bay Company has reversed the usual order in which civilization entrenches itself in a new land. This is, according to a familiar axiom, first the missionary, then the soldier, then the trader. Here the trader anticipated the missionary and used so much tact and diplomacy in his dealings with the Indian that the soldier was not needed. This historical sequence has led certain irreverent ones to interpret to tourists the meaning of the widely displayed and somewhat mystical initials H.B.C. to signify "Here before Christ". The influence of the company in promoting friendly relations between the Indians and the whites as well as between different Indian tribes cannot be questioned.

Nor can the effect of the Company's activities in holding western Canada for the British Empire before the days of Federation be doubted.

The Mackenzie river has been familiar to fur traders for more than a century as part of a great system of transcontinental waterways by which one can travel by canoe or York boat from the Atlantic to the Pacific oceans (Fig. 14). The principal links in this chain of northern rivers are the Churchill, the Athabaska, the Mackenzie and the Yukon. Long before transcontinental railways were dreamed of, many thousands of tons of merchandise were conveyed in York boats and scows, via Hudson bay, over these great rivers and the short portages connecting them, to be offered to the Indians of the interior in exchange for furs.

The great value of the furs which the northern forests yield was known to these hardy traders more than fifty years before the mineral wealth of the country was suspected. In order to gather the rich harvest of furs in the Yukon valley, the Hudson's Bay Company established a trading post at Fort Yukon in 1847. From this point Fort Selkirk, several hundred miles up the Yukon in Canadian territory, was supplied. The cargoes of supplies which came down the Porcupine from the Mackenzie were tracked up the Yukon in big bateaux by Indians. Fort Yukon remained an important trading post of the company until 1867. After the purchase of Alaska by the United States, Fort Yukon was found to be west of the boundary. It was accordingly abandoned by the Hudson's Bay Company and the post was moved up the Porcupine about 150 miles to a site supposed to be on British territory. The accurate location of the boundary later necessitated a second move of the post.

The single name—Northwest Territories—which formerly included all of the region now under consideration has been superseded by four names—District of Keewatin, District of Mackenzie, District of Franklin and Yukon Territory.

GEOGRAPHICAL FEATURES.—The population of the Yukon valley is chiefly centred near the Klondike mining district at Dawson. Elsewhere white men are sparingly and widely scattered throughout the mountain valleys in prospectors' cabins. The Yukon valley, like that of the Mackenzie, is forested throughout its length. Toward the north the trees, though small, are suitable for building cabins and for fuel. A small Indian population is scattered through the Yukon basin in small groups.

Eskimo occupy widely separated areas along the Arctic coast near the mouth of the Mackenzie river and in the Coronation Gulf region.

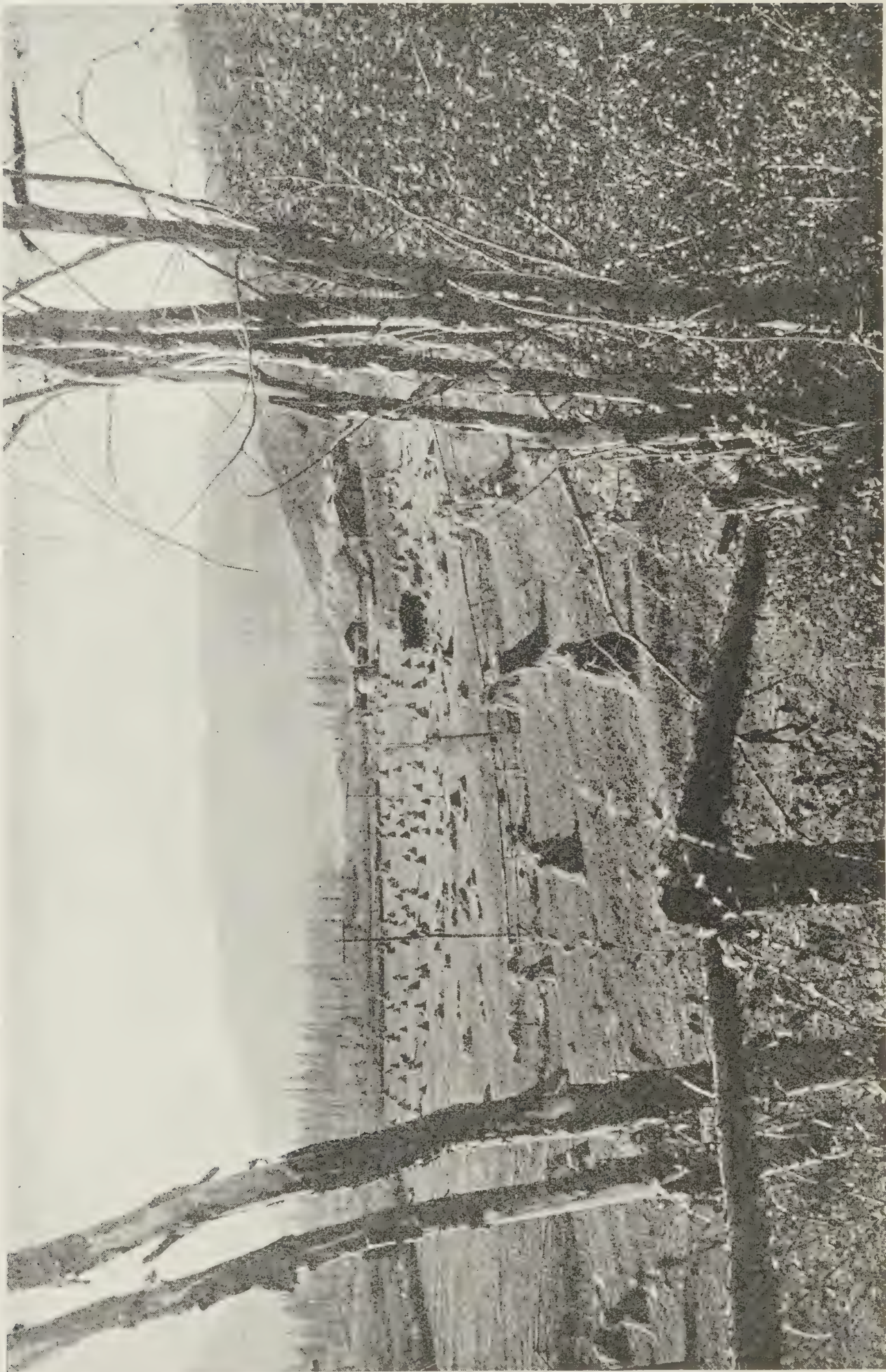


Fig. 10



FIG. 16. A. A SUMMER DOG TEAM.
 B. A NOON HALT FOR TEA, CROSSING GREAT SLAVE LAKE.
 C. ARCTIC COAST ESKIMO ON A JOURNEY.

A



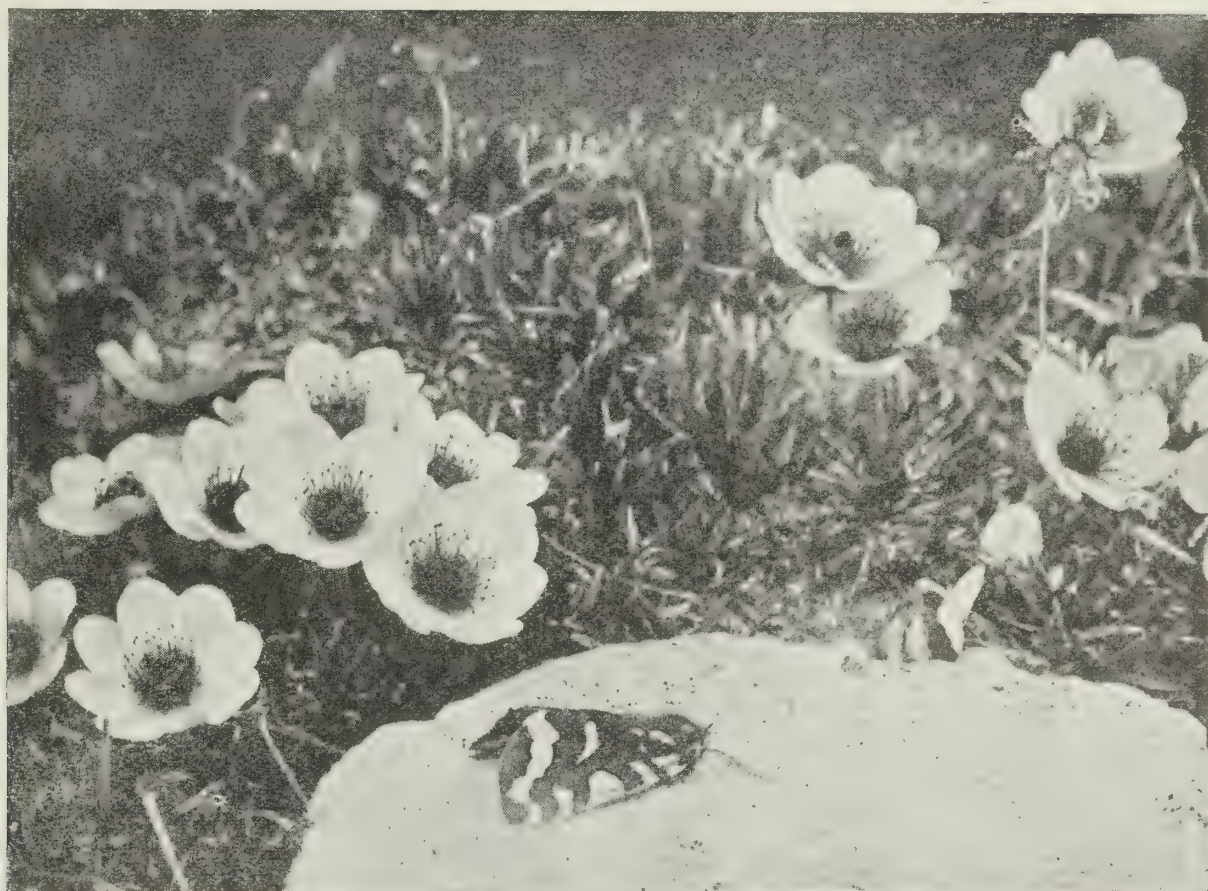
B



C



FIG. 17. A. VIEW DOWN SLAVE RIVER FROM FORT SMITH.
B. SPRUCE FOREST, LOWER SLAVE RIVER.
C. VIEW FROM SHORE OF GREAT SLAVE LAKE.

*Fig. 11*

They also occupy points favourable for hunting and fishing on the west coast of Hudson bay, north of Churchill, Chesterfield inlet, and the shores of the large lakes southwest of Chesterfield inlet. The remainder of the Arctic Prairies is uninhabited except for a few small bands of Indians about the eastern ends of Great Slave lake and Athabaska lake.

Since there are no roads and very few trails, travel in the Mackenzie valley is strictly limited to the waterways. Everywhere dense forests of spruce and poplar, muskeg or small lakes cover the lowlands near the rivers. These generally render travel across country nearly impossible or extremely slow.

In all of the 1200-mile stretch of lake and river between the end of steel at McMurray and Norman (Fort Norman) the traveller will see only eight or ten Indian villages with two or three fur-trading stores at each to interrupt the virgin forest (Fig. 11). The total population of the entire Mackenzie district will probably not exceed 5,000. Probably less than 150 of these are whites, the remainder being Indians, except 200 or 300 Eskimo. Anglican or Roman Catholic missions are maintained at nearly all of these villages.

The Indians depend for a livelihood entirely on trapping, hunting and fishing. At the trading posts the tea, flour, sugar, tobacco and a few other things which the white man has taught them

to regard as essential to their welfare can be obtained in exchange for the winter's catch of fur—lynx, fox, marten, etc. The relative abundance of the lynx fluctuates from year to year in a very curious way. The supply of rabbits is an important matter to the lynx, since they are his main source of food, and the failure of that supply means the starvation of a large part of the lynx of the region. Not a single rabbit was seen during the writer's trip down the Mackenzie in 1917. The naturalist, Edward Preble, who traversed the Peace and Slave rivers in 1903, found rabbits very abundant and records having seen nearly forty in one day. During the same year the abundance of lynx in the region was attested by the hundreds of lynx pelts traded in at Fort Simpson. According to general report, periods of great scarcity and great abundance of the rabbit population follow each other at intervals of about seven years (Fig. 12).

The wolf is less dependent on rabbits than the lynx, but it, too, no doubt suffers in the lean years.

A superstitious fear of wolves prevents many of the Indians from killing them, notwithstanding the generous government bounty. The basis of the truce between the Indian and the wolf has been stated thus by one chief: "A long time ago the wolf was the man's dog, and they hunted the moose equally. But the man began to take more than his share, and the wolf was angry. He

began to hunt for himself and he found he did not need the man's help. Ever since then the man and the wolf have hunted the moose separately. But before they parted they made a treaty. The man agreed never to kill the wolf, and the wolf agreed never to break into the man's caches."

The Royal Canadian Mounted Police is represented by about fifty non-commissioned officers and men distributed throughout the Mackenzie valley. Two Government Indian agents, who are also mining recorders, reside in this district.

The Mackenzie River valley includes a wide variety of scenery. Anyone who can feel the pull of the great Northland, and who wishes to see what lies beyond the northern outposts of civilization, can hardly fail to enjoy a summer trip to the lower Mackenzie, provided he does not expect the kind of accommodation furnished by the boats on the St. Lawrence or Hudson rivers.

The Mackenzie is everywhere a majestic and impressive river. Ordinary rivers appear insignificant in comparison with it. Certain portions of the river are known by special designations. Some of these afford in themselves good brief characterizations of the essential features of the river along the portions to which they apply. The Long Reach is one of these. The name includes the nearly straight 80-mile stretch of river which skirts the foot of Bear range north of Norman. This part of the river has an average width of one mile and a current rate of 3 or 4 miles an hour. The narrowest part of the river is found in the Ramparts, a gorge 100 to 180 feet deep and about 5 miles long cut through the nearly flat-lying limestone above Good Hope. The name "Grand View" applies "to an expanded portion of the lower Mackenzie about twenty miles in length. The river here is almost straight, but curves gently to the north, and is from two to three miles wide. Its great width gives it more the appearance of a lake than river, and in no other part of the Mackenzie is the magnitude of the mighty volume of water which this river carries to the sea impressed so forcibly on the mind."

TRANSPORTATION.—The Yukon river has a length of 2200 miles from its source to the sea. It is free from ice from June 1 or a little earlier to October 1 or later. The Northland still remains in the hands of the fur trader, but the canoe brigades and the York boats have given way to the steamboats on the large rivers. On the Yukon the steamboat has followed the successful prospector from its mouth in western Alaska to the head of navigation at Whitehorse rapids in the Yukon territory. From this point to the sea at Skagway the White Pass and Yukon railway now follows the trail over which poured

many of the gold seekers who participated in the rush to the Klondike in the late nineties. Its northern terminus at Whitehorse near lat. 61° is the most northerly point reached by rail in Canada. In Norway, railway travel is possible north of latitude 68°, more than 100 miles north of the Arctic Circle. The 900-mile sea trip (Fig. 9) from Vancouver to Skagway behind a continuous fringe of forest-clad mountainous islands affords probably the longest sea voyage in the world in which the voyager has certain immunity from sea-sickness. Here the traveller may steam toward the land of the Midnight Sun over a sea placid as a lake, and enjoy a visit to the Taku glacier in such commodious vessels as the Canadian National Steamship *Prince George*. It is doubtful whether any journey in North America can equal that from Vancouver to Dawson for variety and charm of scenery (Fig. 10).

The Mackenzie valley has never felt the quickening touch of gold, and the steamer service on it was initiated for and is still maintained by the fur traders. Any approach by rail to the Peace or Athabaska rivers, which are the great waterways leading toward Great Slave lake and the Mackenzie, must be through the city of Edmonton. This thriving modern city was not many years ago only an obscure trading post of the Hudson's Bay Company on the Saskatchewan river. A railroad was completed a few years ago from Edmonton to Peace River Crossing on the Peace river, which is about 312 miles northwest of Edmonton. Another railroad extends north from Edmonton via Lac La Biche to the head of navigation on the Clearwater river. This railway ends near McMurray: from that point to the Arctic coast steamer navigation on the Mackenzie is interrupted at but one point, the rapids at Fort Smith, where there is a portage of 16 miles (Fig. 27B). The Peace River route is longer and involves a four-mile portage at the Vermilion chutes, which the McMurray route avoids, but the railway transportation is more dependable.

During the winter season communication between the Mackenzie valley and the outside world is maintained by dog sledges or carioles which carry the mails in and out of the valley once a month. Only first-class mail, however, is carried on these.

It may well be understood that to the inhabitants of the Mackenzie valley the great seasonal events of the year are the opening and closing of navigation on the waterways of the basin. The ice of Great Slave lake blocks the navigation of the Mackenzie river for nearly a month after the great river is free of ice. Owing to this fact

A



B



C



FIG. 18. A. SCOW RUNNING THE CHUTES OF PEACE RIVER.

B. SIMPSON, MACKENZIE RIVER.

C. MOUNTAINS AT THE GREAT BEND OF MACKENZIE RIVER.

A



B



C



FIG. 19 A. PICKING CUCUMBERS AT SIMPSON.
 B. FLOWER SECTION, EXPERIMENTAL FARM AT VERMILION, PEACE RIVER.
 C. MISSION CHURCH, HAY RIVER, GREAT SLAVE LAKE.

navigation on the Mackenzie is limited to about three and one-half months.

The Mackenzie at Simpson, which is near latitude 62° opens between May 4 and May 20, averaging from the 10th to the 15th, according to Captain Mills, who has spent several years at Simpson and has run steamers on all of the navigable waters of the Mackenzie basin. Because of nearly dead water in the Mackenzie for a long distance, the head of the river opens two-and-a-half or three weeks later than at Simpson. The opening of Great Slave lake generally occurs, according to Captain Mills, between June 16 and July 2, or six weeks later than the Mackenzie below Simpson.

The distance from McMurray, the end of the railway and at the head of navigation on the Athabaska river, to the northernmost trading post reached by the Mackenzie River steamers is 1735 miles. Along these northern reaches of the Mackenzie in midsummer the traveller sees not snow and ice but a large variety of flowers and flower-loving insects (Fig. 11).

The construction of a canal a little more than 20 miles in length around Smith rapids would give uninterrupted water transportation from the end of the railway near McMurray to the Arctic ocean, a distance of about 1750 miles. Such a canal would encounter no serious obstacles west of the present portage route and its construction will probably be one of the steps in the economic development of the great valley.

An extension of the Peace River railway to the head of navigation on Nelson river may eventually become a co-ordinate factor in the northward spread of settlement in the region between Peace river and the Rocky mountains. This would make available for agricultural development the very extensive area lying between Peace river on the east and the Nelson and Liard rivers on the west. The region about the headwaters of the Hay, Black and Nelson rivers is reported to be about half prairie land and is without a doubt one of the most promising large areas in western Canada from the standpoint of agriculture and grazing. A very important function of such a railway would be to give early access to the Mackenzie River basin. The writer has pointed out elsewhere¹ that the construction of a railway from St. Johns to Fort Nelson, a distance of about 175 miles would, owing to the late opening of Great Slave lake, give access to the Mackenzie river more than a month earlier than is now possible.

Steamers leave Fort Smith for the first trip down the Mackenzie about June 24. With them go the winter's accumulation of magazines, paper and other second-class mail, and the annual "permit" or small allowance of liquor which each white man in the remote northern cabins may obtain from the "outside" (Fig. 13). They usually depart from the same point on the second trip about July 26. The navigable waters of the Yukon and Mackenzie basins about the head of the Mackenzie River delta are separated by a portage route of 60 miles. The Hudson's Bay Company once staked out a cart trail over this route and it will probably be bridged by a motor road or tramway eventually.

It is necessary to begin the return trip from Norman not later than September 28th if a winter sojourn is not planned.

No railway or steamboat lines enter the Barren Lands or Arctic Prairies east of the Mackenzie basin. The Hudson Bay railway, when completed, will touch the southeast corner of this vast region. Access to it may be had by various canoe routes. On the Hudson Bay side, Chesterfield inlet and Churchill river, with the lakes and rivers connected with them, furnish waterways by which the voyageur may cross the Arctic Prairies with numerous portages to the Mackenzie basin.

CANOE TRAVEL.—Over a vast area in north-western Canada the traveller has no other choice but the way of the voyageur. Away from the two great trunk streams, on the Yukon and the Mackenzie, the tracking line, the pole, and the paddle, hold their ancient supremacy. On large streams where portages are few and far between there is no more delightful way to travel than by canoe (Fig. 14).

In the northern latitudes where daylight lasts about 24 hours in June, it is feasible for large canoes to travel day and night if the party wishes to speed up. The mosquitoes are less active during the cool nights, which is often another incentive to night travel. The writer has covered the 200 miles stretch between Fort Smith and Resolution by day and night travel in 2½ days. This method for short periods involves no hardship, if the night is divided into two or more watches with only one man at the paddle, while the others sleep or study astronomy from the bottom of the canoe.

The northern rivers disclose only half their charms to the man who knows them only in the bright forenoon and afternoon sunlight. It is after the long delayed sunset that the great, gloomy unexplored spruce forests assume their air of greatest mystery and fascination. The dark-green tops of the tall, slender spruce trees

¹ Kindle, E. M., Arrival and Departure of Winter Conditions in the Mackenzie River Basin: *Geogr. Review*, vol. X, p. 392, Dec., 1920.

are apt to be first outlined sharply against a rose-tinted northwestern sky. This may fade to various tints of purple, green or gray, but not into the darkness of southern latitudes. At midnight there is plenty of light for safe canoeing but not enough to be sure whether a dark object on the bank a few hundred yards away is a moose, a bear or only a black stump. Frequently the canoeman will see in the dim light near the shore a huge finger-like apparition waving furiously in the strong current and pointing downstream as if some river god were pointing the way and admonishing the voyageur not to tarry in his kingdom. An occasional booming splash breaks the midnight stillness as some stately spruce, undercut by the river, drops into the stream with a portion of the bank. If the mass of earth and stones on the roots is large they may anchor it on the river bottom and after the spring break-up of the ice has stripped off its branches it may become one of the weird looking vibrating finger boards. The quiet solemnity of the night is sometimes broken by bird notes.

The approach of sunrise, which in June comes about 2 o'clock on the Slave, brings with it not only a feast of colour for the eye in the north-eastern sky, but a rich blending of odours which at sunset gave no evidence of their existence. In latitude 60° the sun's long winter neglect is atoned for in a way by the magnificence and length of the sunsets. The sunset glow, which in southern latitudes is so quickly blotted out by the blackness of night, lasts here until it slowly merges into rose-hued dawn. The sun is visible all night for about a week in the month of June, on the Porcupine, but during the early part of August the sun drops below the northern horizon about ten o'clock. Till it reappears a little after two in the morning, the whole northern sky is aglow with a glory of colours.

There are only two points on the entire Mackenzie river where the canoeman needs any special advice in regard to avoiding rapids. One of these is opposite the site of old Fort Wrigley. Here the river splits on a rocky island. Loaded canoes and scows should take the west channel. The narrow eastern channel is rather swift water. The other locality is the Sans Sault rapids. Here also the canoeman should take the west side of the river, keeping near the shore. The Vermilion chutes (Fig. 18) on the Peace river and the Smith rapids on the Slave are always portaged. On the Yukon the canoeman can travel from Whitehorse to the sea, a distance of 2,000 miles, without taking his canoe out of the water.

The maze of lakes and their connecting streams

make it possible to cross from one watershed to another and to reach nearly any part of northern Canada by means of canoes. But away from such great trunk streams as the Peace or Mackenzie, rapids, falls and portages are numerous and "tracking" and "poling" become very essential features of canoeing. Most of the smaller rivers can be traversed only with the aid of Indian or other skilled canoemen.

In the rapids and swift waters which characterize most tributaries of the Mackenzie and the rivers of the Arctic Prairies the expert canoeman who likes the red-blooded sport of running white water will find unlimited opportunities to enjoy this exciting game. In some of these streams small but troublesome rapids occur widely and irregularly spaced where the voyageur must frequently take to the water and "frog" his canoe through the menacing boulders. In the case of one northwestern river familiar to the writer, the Indians consider the rapids to represent the footsteps of an evil spirit who once traversed the stream. Such stretches of strenuous water lead the canoeman, who must laboriously pole or line his canoe upstream through them, to hurl a variety of evil maledictions at the threatening ledges and ragged boulders gleaming through the yellowish-white water. Generally the boulder teeth of the rapids retaliate with nothing worse than an occasional slash through the canvas cover of the canoe.

FORESTS.—Dense forests border the Yukon and Mackenzie rivers and their tributary streams throughout their length (Fig. 17). These forests usually consist of trees which seldom exceed a foot in diameter, although occasional trees may reach twice this size. The heavily wooded character of the banks of the rivers, together with the muskegs, make travel inland from the rivers extremely slow and difficult where no trails exist. The more common trees are the black pine (*Pinus murrayana*), the white spruce (*Picea alba*), and the smooth and rough barked poplars (*Populus tremuloides* and *P. balsamifera*). Jackpine, larch, willow and alder are also frequently seen.

The steamboats depend entirely upon the riverside forests for fuel. Lumber for local use is cut by small saw mills in the Mackenzie basin located at Grand Detour and Fitzgerald. An abundance of timber large enough for building cabins and other local uses is found along the Mackenzie as far north as the delta and also along many of the smaller rivers to the east of the Mackenzie valley.

During seasons of unusually high water a great deal of driftwood is carried to the sea by the Yukon and Mackenzie rivers. Most of the

driftwood from these and other rivers eventually lands on the coasts of Alaska and Canada, where vast quantities of forest debris, consisting largely of good-sized logs and trees, are piled up on the beach adjacent to land which affords nothing in the shape of timber larger than the Arctic willow, which seldom grows higher than a man's head. When floating trees are not too numerous the voyageur sometimes utilizes one of the larger trees which still retains the branches to make progress against an up-river wind. The deeply submerged branches cause the strong subsurface current to bear such a tree and any canoe which may be attached to it into the teeth of an up-river breeze as effectively as the under-water sail expedient, which is often resorted to when a floating tree is not available. Even in fair weather the floating tree is often made use of to save time for the voyageur on the Mackenzie. By lashing to a suitable tree he can cook his meals while proceeding on his way. If for any reason night travel seems desirable, the canoe may be secured to an Arctic-bound tree at bedtime and an undisturbed sleep obtained.

The driftwood from the Slave and Peace rivers generally ends its northward journey on the shores of Great Slave lake (Fig. 21) so that the driftwood on the Mackenzie is derived chiefly from its tributaries north of this lake. The Gravel, the Peel, and other large western tributaries of the Mackenzie doubtless carry quantities of driftwood into the main stream, but the great bulk comes from the Liard river. The timber growing on the banks of the Liard and its southern branches is about as large as that found on the Peace and Slave rivers, and its driftwood includes many trees from one to two feet in diameter. The unusually high stage which the Liard reached in 1919 set afloat a vast quantity of stranded logs, many of which had started their northern journey in previous years. At the time the mouth of the Liard was passed on July 1, it was discharging very little driftwood. The vanguard of the main volume of the Liard driftwood reached Old Fort Good Hope on the lower Mackenzie about July 13. At that time the writer was using a canoe a short distance above the old fort and had an opportunity to get a clear conception of the great volume of the floating mass of trees, logs, limbs and bark. This floating mass of travel-scarred tree trunks and forest debris greatly exceeded in volume anything previously seen or imagined. In general it formed a nearly continuous mass a quarter of a mile or more in width. When, as frequently happened, the mass of drift spread out under the influence of a breeze or current which carried it toward the middle of

the river the width often exceeded a mile. Walking over this driftwood was often more feasible than canoeing through it. The closely packed phase of this particular exodus occupied about four days in passing a given point. Detached masses of small size and single, widely scattered logs followed it for several days. Spruce and poplar comprise the great bulk of the Mackenzie driftwood. Here indeed is a mammoth supply of pulpwood delivered at tidewater, cutting and transportation free, that merits the consideration of any enterprising paper company which can solve the commercial problem of transportation around the Alaskan coast.

VEGETATION AND AGRICULTURE.—All traces of winter conditions have disappeared from the Mackenzie valley by the time the first steamer is able to get through Great Slave lake to the head of the river, which is usually early in July. Concerning the climate of early summer, Keele, who wintered near the head of Gravel river in lat. $63^{\circ} 30'$, remarks that "June is a perfect summer month with practically no darkness and on fair days nearly twenty hours of bright sunshine; the temperature sometimes reaches as high as 90° ."¹

The nearly continuous sunshine of June is the great factor in the rapid development of vegetation. "Compared with Ottawa, Simpson has an average of three hours more sunlight daily for the summer months, which means about eighteen days of additional sunlight during the three months when sunshine is most important"² (Figs. 19 and 20).

A traveller in the Mackenzie valley who sees for the first time the limestone scarps and cliffs of the Mackenzie mountains so near the Arctic zone entirely free of snow in midsummer, is apt to be surprised when he recalls the glaciers and permanent snow fields which are familiar features of the same mountains many hundred of miles farther south (Fig. 18C). The Nahanni mountains of the Mackenzie valley, which are quite free of snow in July, are in about the same latitude as the mouth of Frobisher bay, Baffin land, where the writer has seen a ship stuck for days in the ice flows and experienced a snow storm late in July. The warm genial summer climate of the Mackenzie valley cannot fail to impress anyone who is familiar with the bleak coasts of north-eastern America which lie in the same latitude. Although the middle portion of the Mackenzie

¹ Keele, Joseph. A Reconnaissance Across the Mackenzie Mountains on the Pelly, Ross and Gravel Rivers, Yukon and Northwest Territories, Geol. Surv., Dept. of Mines, Ottawa, p. 22, No. 1097.

² Camsell, Chas., and Malcolm, Wyatt: The Mackenzie River Basin, Geol. Surv. Can., Memoir 108, Geol. Ser. No. 92, p. 43, 1919.

valley lies in about the same latitude as Baffin land, its summer climate bears a much stronger resemblance to that of Gaspe peninsula south of the Gulf of St. Lawrence than it does to the Baffin land summer. Dr. Camsell, who has a more intimate knowledge of the climate of the Mackenzie valley as a whole than anyone else who has written on the subject, states that "in general it may be said that any point in the Mackenzie basin has a milder climate than any corresponding point of the same latitude in northern Manitoba, Ontario, or Quebec".¹ The relatively warm summer climate of the Mackenzie valley may be ascribed chiefly to its remoteness from the chilling influence of Hudson bay and to its low average elevation. Most of this great lowland is less than 500 feet above sea level, while much of the northern half of Alberta immediately south of it lies at an elevation of 2,000 feet or more. Warm air currents from the Pacific may also be a factor (Fig. 22).

Many varieties of flowers in bloom crowd the fire-cleared spaces of the lowland and the mountain slopes early in July. Among these, orchids occur locally in abundance. Ripe red raspberries were seen on August 7 at Bear mountain, which is about 80 miles south of the Arctic Circle. Blueberries were a feature of the writer's camp fare from the first week in August to the end of the summer.

In the vicinity of the Mackenzie delta perpetual frost reaches so near the surface in summer as to make the raising of any save the hardiest vegetables impracticable. In the Yukon valley at Fort Yukon, located just at the Arctic Circle, and at Good Hope on Mackenzie river, a short distance south of the Circle the writer has seen fine-looking gardens in which potatoes were the most conspicuous vegetables. An old government statistical report states that at Fort Yukon, lat. $66^{\circ} 37'$, barley and other cereals are grown. Old Russian records give 59.7° as the mean for June, July and August at Fort Yukon.

The gardens, kept by agents of the trading companies, which may be seen at intervals of 150 to 200 miles along the Mackenzie, show that excellent crops of all the more hardy garden vegetables may be grown in favourable seasons as far north as the Arctic Circle. Potatoes which the writer selected from a field at Simpson weighed in two or three cases a few ounces over a pound each. A turnip—the largest of a lot purchased for camp use from an Indian garden at Simpson—had a length of nine inches and a diameter of five inches, the long tap root not being included in these figures. The

largest turnip ever seen by the writer was grown near the shore of Great Slave lake. Oats and barley are raised at Simpson, lat. $61^{\circ} 50'$ and wheat sometimes succeeds there. A few cattle are kept there on the government farm, wild hay being used for feed. August or July frosts are not unknown, but in favourable seasons the crops compare well with those raised in southern Canada.

Thawing in the southern part of the Mackenzie valley proceeds downward a few feet below the surface in summer. Mr. Harris, who is in charge of the government farm at Simpson, states that his well entered frozen ground at a depth of about 5 feet and passed out of frost at about 40 feet. A frost limit of 40 feet is in sharp contrast with the conditions prevailing in the Yukon valley and the Nome district in Alaska. Near Nome a shaft 120 feet deep did not penetrate below perpetual frost. Cleveland Abbe states that "there is only one instance on record where excavation in this northwestern region has gone below the zone of perpetual frost".¹ This is a Klondike shaft which passed through the frost zone into flowing water at about 220 feet.²

The relatively moderate depth of frost penetration in the upper Mackenzie valley as compared with the lower limit of frost in the Klondike and much of northern Alaska clearly indicates a climate more favourable to agriculture in the former region.

Old Hudson's Bay records show that on the Upper Liard river wheat, barley, rye, oats, Indian corn, potatoes, turnips and other vegetables put in the ground at Fort Halkett, lat. $59^{\circ} 30'$, towards the end of May, are generally mature towards the end of August. Flowers blossom the first week in May. Wheat is a sure crop four years out of five. The climate is similar to that of Manitoba, but improved by Chinook winds. Frost penetrates the ground about four feet. River freezes over about the middle of October.³

At Fort Vermilion (Fig. 19) on Peace river near lat. $58^{\circ} 30'$, the writer was told by the Superintendent of the Government Experimental Farm that wheat had failed to mature in but three years out of twenty-seven. Experiments are in progress there in growing a number of fruit trees and shrubs as well as with the grains commonly grown in northern climates. Wheat and oats are

¹ Brooks, A. H.: *The Geography and Geology of Alaska. A Summary of Existing Knowledge; with a Section on Climate* by Clegland Abbe, Jr.: U.S.G.S. Prof. Paper, No. 45, Washington, D.C., p. 147, 1906.

² Tyrrell, J. B.: *A Peculiar Artesian Well in the Klondike: Engineering and Mining Journal*, vol. 75, p. 188, 1903.

³ Baillairge, G. F.: *Canada from the Atlantic to the Pacific and Arctic Oceans, Arctic Voyages, Voyages of Discovery in the North and Public Works, etc., etc.*, p. 127, 1889.

¹ Camsell, Chas., and Malcolm, Wyatt.: *Op. cit.*, p. 43.



FIG. 20. DOMINION EXPERIMENTAL FARM AT BEAVERLODGE, ALBERTA,
NEAR LATITUDE 56.

A. PLOTS OF WHEAT AND OATS.

B. AN INSPECTING PARTY AT THE FARM.

C. PLOTS OF CLOVER.



FIG. 21. A. THE LOWLAND PLAIN, SOUTH SIDE OF GREAT SLAVE LAKE.
 B. DOG TEAMS EN ROUTE FROM CHIPEWYAN TO McMURRAY.
 C. DRIFTWOOD, SHORE OF GREAT SLAVE LAKE.

reported to mature in ordinary seasons at Simpson in lat. 61° 50'. All of the south shore of Great Slave lake (Fig. 21A) will, in the writer's opinion, be found to lie within the wheat belt.

It is not a recent discovery that wheat of the finest quality can be grown north of 56°. Half a century ago, at a time when people in the United States and eastern Canada were still denying that wheat could be grown in southern Manitoba and Alberta, Fort Chipewyan on Lake Athabaska in lat. 58° 42' won the Centennial Exhibition prize for wheat weighing 68 to 69 pounds per bushel.

after viewing the sights of London, what they would say to their countrymen about them, replied that they would tell them nothing lest they be considered liars. Not all of them, however, have been reticent about their knowledge of the agricultural and other resources of northern Canada. As long ago as 1752 Joseph Robson, a surveyor, published a book in which he sharply reprimanded the Company for its neglect of all the country's resources except the furs. His opinion of the climate and the fertility of the soil is clearly expressed in the following extract:¹

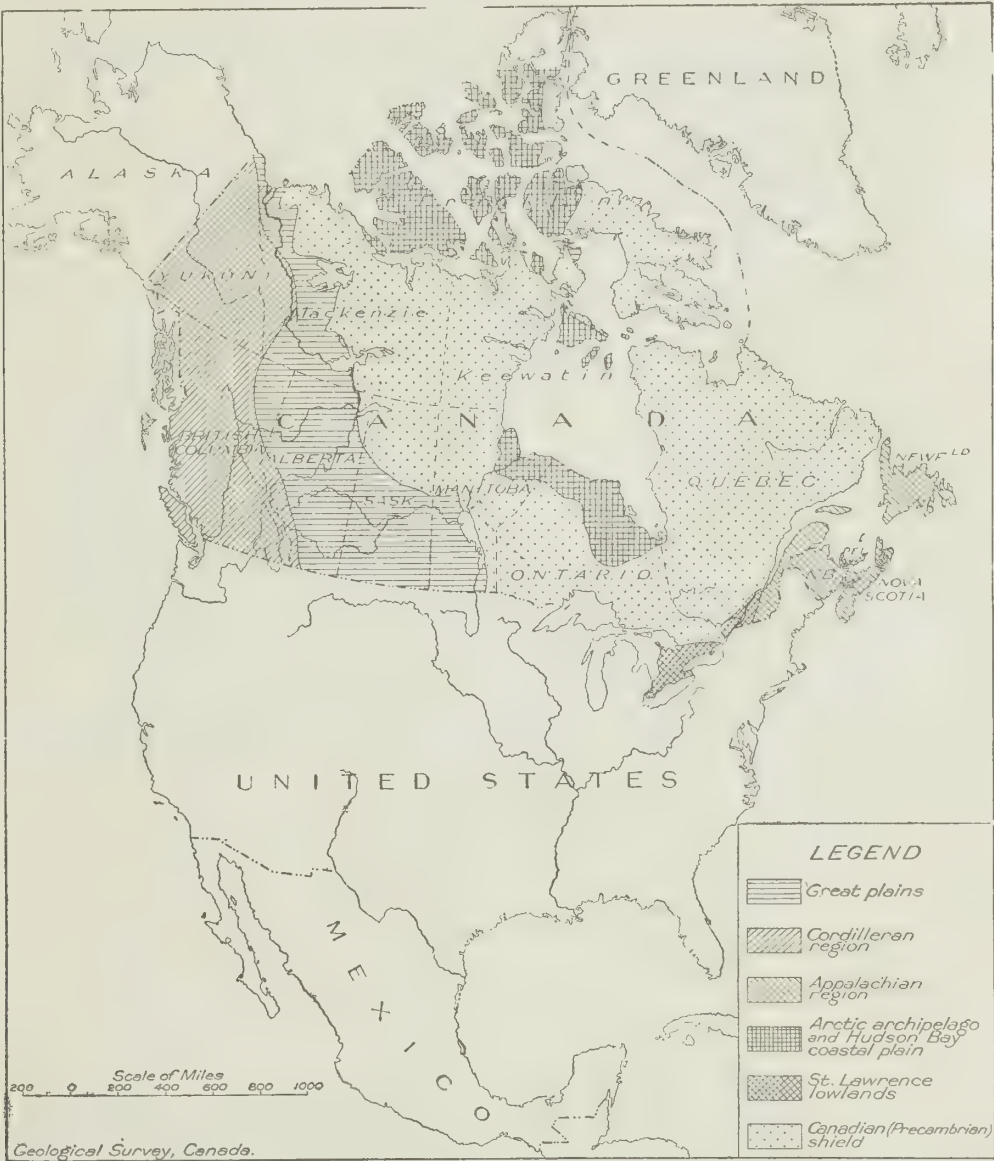


Fig. 22

But why should the traders bother about growing wheat which the Great Company had no use for? The annual “permit” or jug of whisky for medicinal purposes (Fig. 13) and the year’s supply of magazines and papers came regularly once a year and that was enough to look forward to.

Many of the old Hudson’s Bay post managers have probably felt about their knowledge of the agricultural possibilities of the Northwest somewhat like Cartwright’s Eskimo who, when asked,

“But in the coldest part of winter, I have lain many a night in the open air, with only a fence to windward made with branches of trees, and a fire upon the ground, and sometimes by the veering of the wind, both fence and fire have been rendered totally useless: and yet I can honestly say, that I was never ill half an hour all the time

¹ Robson, Joseph: *An Account of Six Years' Residence in Hudson's Bay from 1733-1736 and 1744-1747*, pp. 78, 81, 82; London, 1752.

I staid in the country [six years] The soil is fertile and the climate temperate, fit for the produce of all kinds of grain and for raising flocks of tame cattle: and the coast abounds with black and white whales, seals, sea-horses and various kinds of small fish."

GRAZING.—In the Yukon basin the mountainous character of the country precludes any commercial development of either grazing or agriculture. But even there the long nightless days will make the valleys produce grain as well as gold if the miner cares to become a farmer. The photograph (Fig. 10) shows grain grown on one of the famous gold creeks.

The Mackenzie basin, including the high tablelands cut by the Peace and Athabaska rivers, has however, a promising future in this field if we can judge from geographic analogies. On the western plains of southern Canada and the northern States the sequence of events connected with their settlement has been (a) the disappearance of the buffalo, (b) the coming of the cattleman, (c) the coming of the farmer. The buffalo has vanished from all of its old range in Canada except a block of territory south of the western third of Great Slave lake, where a considerable number still thrive under government protection. But neither the cattleman nor the farmer has taken over the vast grazing territory between the Rocky mountains and the Slave and lower Peace rivers. If the wild buffalo still living between the parallels of 59° and 61° west of Slave river is not sufficient evidence that cattle will thrive in these latitudes, and live during much of the year on the range, the fine herd of cattle kept by the Roman Catholic Brothers in the Salt River valley 18 miles west of Fort Smith should be. The name of the principal stream in this region—Hay river—should also encourage the cattleman to try out the possibilities of the region. At Simpson near latitude 62° a few cattle are kept and oxen are used for ploughing. There is no reason, so far as luxuriant pasture is concerned, why cattle should not be raised in the Mackenzie valley as far north as the Arctic Circle and even beyond. The reason they are not generally kept at the posts is that the small number of white men in the Slave and Mackenzie valleys are fully engaged in handling the annual \$2,000,000 catch of furs.

Stretching eastward from the timbered lands and mountains of the Mackenzie basin to Hudson bay is the most extensive grazing region in North America. It includes most of the Canadian Shield west of Hudson bay north of 56° (Map, Fig. 22). It is a prairie region which owing to the absence of timber was long ago libelled with the name "Barren Lands" which has stuck to it

in spite of such descriptions as that of E. A. Preble, the naturalist, who states that "thousands of lakes dot its surface, and they are often bordered by grassy plains and gentle slopes, on which during the short summer, the bright flowers of a profusion of shrubs and herbaceous plants lend their beauty to the landscape, and prove the appellation 'Barren Grounds' to be a misnomer." Barren Lands, the name by which this vast region is best known, leads one to expect a description of it to read something like Washington Irving's account of a part of the State of Idaho, "where nothing meets the eye but desolate and awful waste; where no grass grows nor water runs, and where nothing is to be seen but lava".¹ It is therefore a genuine surprise to hear Ernest Thompson Seton's account of it. "And what a region it is for pasture. At this place it reminds one of Texas. Open, grassy plains, sparser reaches of sand, long slopes of mesquite, mesas dotted with cedars and stretches of chapparal and soapweed. Only, those vegetations here are willow, dwarf birch, and ledum, and the country as a whole is far too green and rich. The emerald verdure of the shore, in not a few places, carries me back to the west coast of Ireland"². Tyrrell, who collected in this region, which he calls the Treeless Plains, 124 flowering plants, characterizes it as "a vast undulating plain, underlain by a stony clay, and covered with short grass or deciduous Arctic plants. In certain sections no rising ground can be seen for miles around, and in other sections rocky hills rise throughout the general covering of clay. The whole land reminds one forcibly of the great plains of western Canada, the chief points of difference being caused by the difference in the underlying rocky floor"³. The Arctic Prairies have been estimated to have an area of more than 400,000 square miles, or more than three times the size of Great Britain, and to be the home of more than 30,000,000 caribou. Surely as a name for such a country, "Barren Lands" should give way to Arctic Prairies, the Great Lone Land, or better still the Caribou Plains.

The population of this great empty land is limited to a few small bands of Eskimo who are confined to the coast and lake region west of Hudson bay and the Arctic coast. The natives depend chiefly on the caribou for clothing (Fig. 24).

Whatever may be the total number of caribou ranging over this vast region, all observers of the

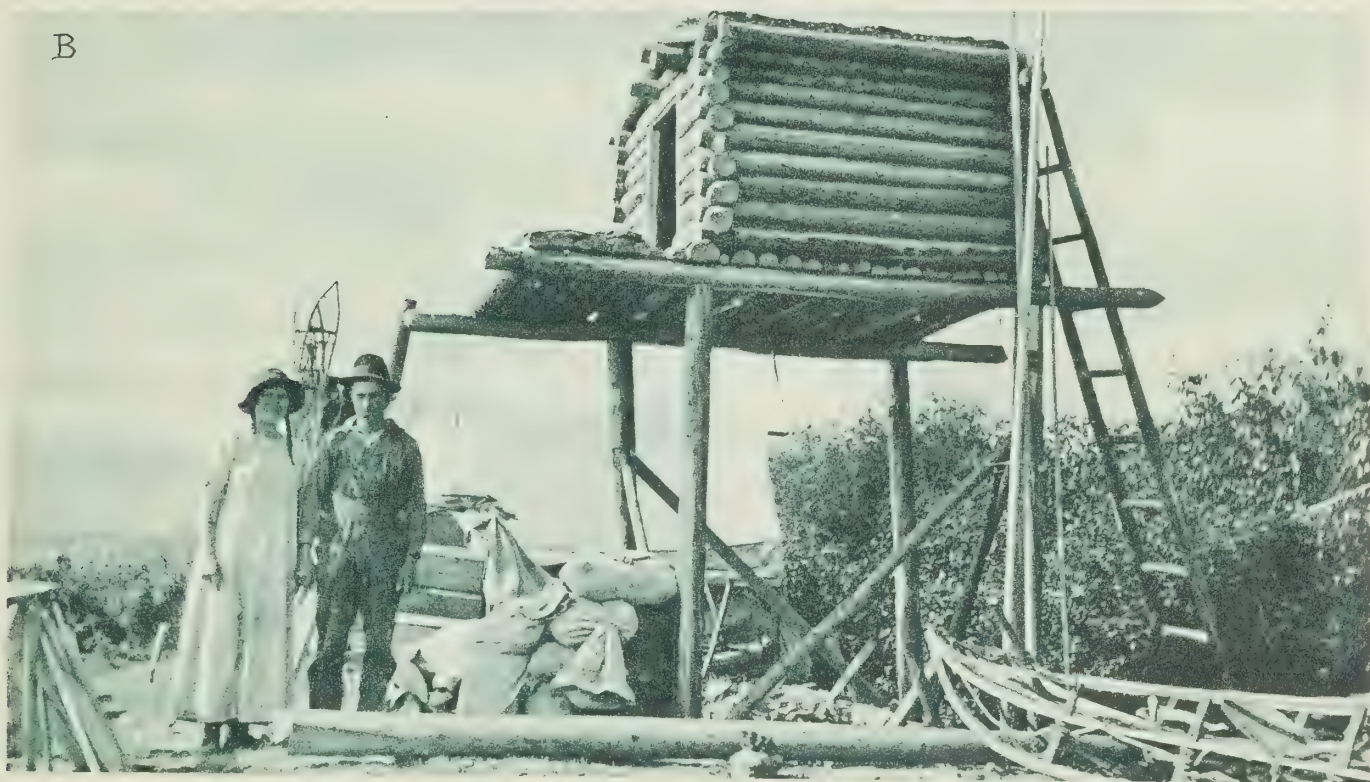
¹ The Adventures of Captain Bonneville, U.S.A., New York, p. 203, 1868.

² Seton, Ernest Thompson: The Arctic Prairies (London), p. 222, 1920.

³ Tyrrell, J. B.: Nat. Resources of the Barren Lands of Canada: *Scottish Geog. Magazine*, Vol. XV, p. 128, 1899.



B



C



FIG. 23. A. A NORTHERN DOG.

B. A PROVISION CACHE AT NORMAN, USED TO PROTECT FOOD SUPPLIES FROM DOGS.

C. THE ARCTIC PRAIRIES (BARREN LANDS), EAST OF GREAT SLAVE LAKE, IN AUTUMN.



FIG. 25. REINDEER, AND HALF-BREED ESKIMO GIRLS AT CAPE PRINCE OF WALES, ALASKA.

annual migrations agree that these animals appear at times in enormous numbers. During the summer of 1893, while travelling northward between Athabaska lake and Chesterfield inlet, the Tyrrell brothers¹ saw on the shores of Carey lake, about latitude 62° 15', a herd estimated to

Warburton Pike saw enormous numbers at Mackay lake, October 20, 1899, and says: "I cannot believe that the herds of buffalo on the prairie ever surpassed in size *La Foule* (the throng) of the caribou. *La Foule* had really come and during its passage of six days I was



Fig. 24

contain 100,000 to 200,000 individuals. It was reported that in 1877 caribou crossed the north arm of Great Slave lake on the ice in an unbroken line which was fourteen days in passing, and in such a mass, that in the words of an eye witness, "daylight could not be seen" through the column.²

¹. Canadian Geological Survey, Annual Report, vol. IX p. 165, 1898.

². Frank Russel: Explorations in the Far North, p. 88, 1898.

able to realize what an extraordinary number of these animals still roam the Barren Grounds". In 1917 Inspector K. F. Anderson of the R.N.W. M.P. then stationed at Fitzgerald, Slave river, wrote³ that "the caribou are within 35 miles of this place (east) in tens of thousands and the natives are getting numbers of the animals and will therefore have plenty to eat this winter."

³. Letter to E. M. Kindle, December 15, 1917.

The great value of the caribou to the Indians and Eskimo who live on or near the borders of the Arctic Prairies can scarcely be overestimated (Fig. 25). Their presence will make relatively easy the work of the prospector and others in this region who will in the future find it desirable to "live off the country", in part at least.

There can be no doubt that domestic reindeer can be raised in the Arctic Prairies as successfully as in Alaska, where the herds doubled their numbers in two and one-third years. When the introduction of domestic reindeer into this region is undertaken the assistance of Lapp or other experienced herders will be required for some years. The rules and regulations summarized by C. Gordon Hewitt¹ which have put reindeer raising on a commercial basis in Alaska may well be carefully studied in this connection. The raising of reindeer and the shipment of the meat to eastern cities should eventually become an industry of importance not only in the "Barren Lands" but in other lands about the northern half of Hudson bay and the Arctic islands.

The economic value of the reindeer has been very clearly stated by Dr. Grenfell. He says²: "Few other animals on the earth's surface offer as much to man with so little outlay. With scarcely any aid, races of men can subsist on what these beasts alone can provide. For transport they have been shown, under right circumstances, to be able to compete with the Eskimo dog in speed and endurance. On the Alaskan tundra, where the snowfall is much like that of Labrador, they have been an unqualified success. On journeys they can find their own food by the way—an item most important, for the dogs are obliged to carry this additional, and by no means inconsiderable, burden with them. Reindeer are now used not only for packing over open land uncovered with snow in summertime, when dogs are entirely useless, but they are in regular use for running the United States mail service in the depth of an Arctic winter. Geldings are said to be far more readily trained to harness than stags, and are easier to keep in good physical condition. At a pinch, one's steeds may be killed and eaten with relish, while the carcass, where meat supplies are scarce, is always of incomparable value. The tongues and kidneys form great delicacies, and the tongues may be smoked for export. A good-sized stag will weigh three hundred pounds. The large, thickly-haired skin of caribou or of the Lapland reindeer is invaluable for many pur-

poses—for boots, clothing, sleeping-bags, tent and blankets. These skins need scarcely any preparatory treatment. Dehaired and dressed, they make most satisfactory clothing for use in cold climates. The sleek, dark-brown hair of the early fall affords a very beautiful material for ladies' jackets or motor coats, and picked skins for such purposes should well repay exportation; two dollars apiece is the present local price for Labrador deer skins. Some of our deer have snow-white skins in winter, and the hair is as thick as a coconut fibre mat.

Moccasins manufactured from the thinner deer skins make the warmest foot-gear known. The heavier stag skins furnish admirable light, soft, flexible over-clothes. They are perfectly wind-proof, and, when dressed for use, fetch fifty cents to one dollar per pound weight. Stretched, undressed, they are sold by the pound as parchment; this, cut into strips, is rolled up, and sold as *babêche* out of which all the fillings for snowshoes are made. Of this, also, are made the lashings for our sledges and the harness for our dogs. The tough thongs show remarkable elastic strength as they 'feel' the jarring and jolting of the rough trails. The very tendons that are useless as food are amongst our most valuable acquisitions, affording our women all the sewing material they need for making boots, skin-boats (or kayaks), and clothing. These animal tendons are taken and dried, and fetch from ten to fifty cents for each animal. They strip easily into single fibres, and these separate threads form a strong sewing material, which resists water, and yet, when used in boots intended to be water-tight, swells up as soon as the boots are immersed in moisture. In this way leakage through the needle holes is prevented. The tendons do not rot easily, nor do they tear the skin substances, for they contract and expand with that material. Even the horns and hoofs are valuable, and furnish many of the household essentials of the natives. Some of these various manufactured products can be exported to the European markets. Reindeer may thus largely increase the earning capacity of any region, by converting its unsaleable material into valuable products. The fresh rich milk of the does in the summer has also supplied us with what is a vital necessity, and one which was obtainable in Labrador in no other way; while the excellent and easily made cheeses afford a method of storing the nutriment in a palatable and assimilable form without any necessary outlay for a preserving plant."

The musk-ox occupies the northern half of the Arctic Prairies conjointly with the caribou. It is present in no such numbers as the deer, how-

¹. Hewitt, C. Gordon: Conservation of the Wild Life of Canada, Chas. Scribner's Sons, p. 321, 1921.

². Grenfell, Wilfred T. and others: Labrador, the Country and the People (Reindeer for Labrador), 1909.

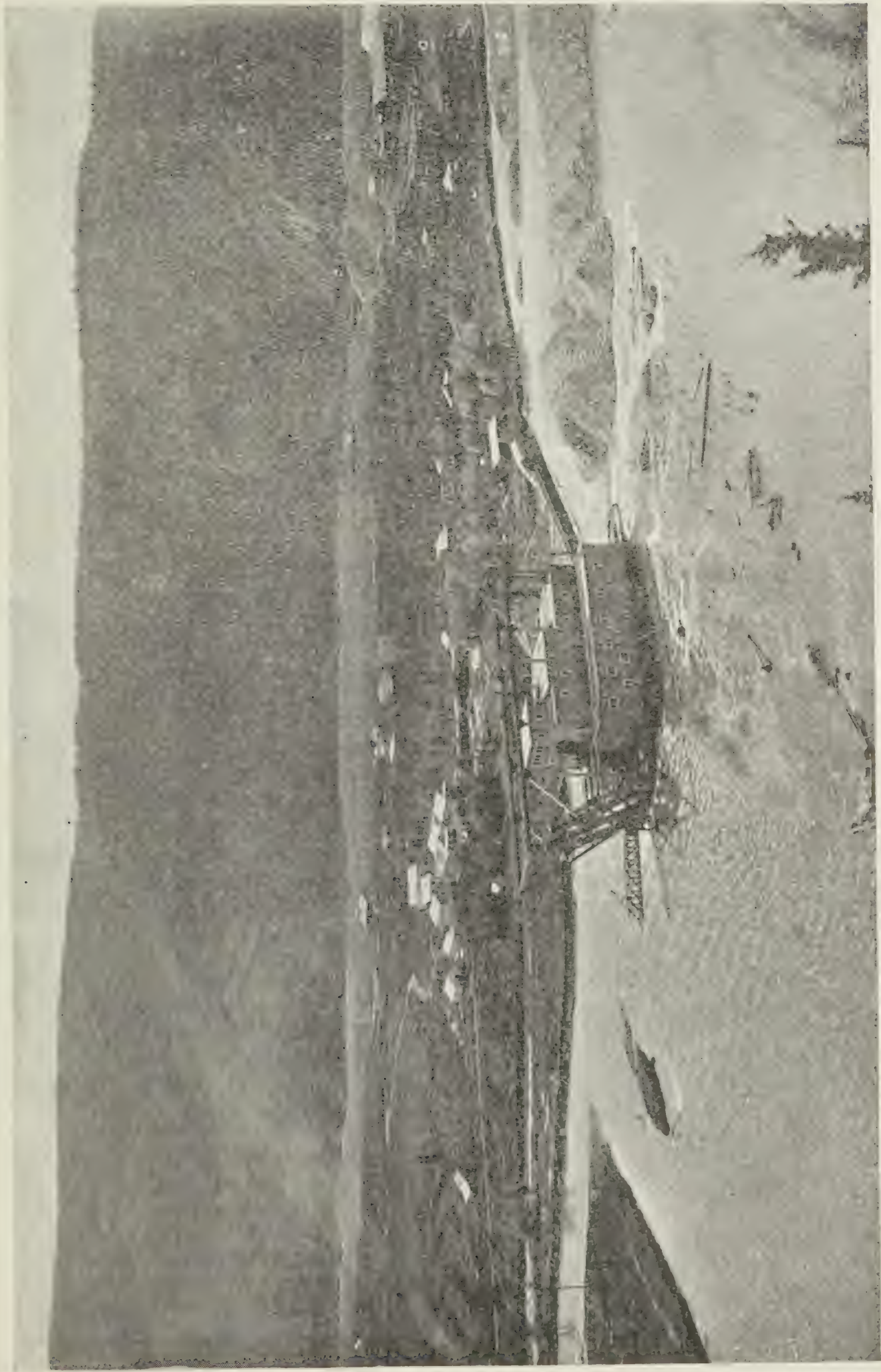


Fig. 26

ever, and appears to be in danger of extinction. The excellence of musk-ox meat and the possibility of utilizing its wool led Professor S. F. Baird to suggest as long ago as 1854 the domestication of the animal. Mr. Stefansson has strongly urged the importance of this, and states that the musk-ox furnishes twice as much meat and fat and three times as much milk as a reindeer. Whether the vicious disposition which, according to Dr. Hornaday¹, characterized the individuals kept for some years in captivity in New York is general and serious enough to prevent domestication can best be tested by experiments within or near the natural ranges of the musk-ox.

The writer's personal knowledge of the west coast of Hudson bay is limited to the region about the southern and western sides of James bay, which, though entirely unoccupied by settlers, is south of the limits set for the present discussion. It may be noted, however, before citing the evidence of others more familiar with the northerly reaches of this coast-line, that parts of the zone of prairie and marsh land bordering the sea-coast, which is generally from 2 to 5 miles wide, may eventually be utilized as a grazing belt. It grows enormous quantities of wild hay and is reported to extend without break from Moose Factory to Churchill and beyond for an unknown distance. It is improbable that it will long remain unoccupied after the railroad to Moose Factory and the Hudson Bay Railway are completed. This coastal zone of prairie and marsh (where the writer knows it) is not, as stated by one author, identical in soil with the "Clay belt" of Ontario, but consists chiefly of marine clay and has greater agricultural possibilities than the glacial till soils of the "Clay belt". It is at present the greatest breeding ground for water-fowl in Canada.

Concerning the game of this zone north of Port Nelson, Nap. A. Comeau has written as follows: "I have visited and shot over most of the celebrated game resorts of this continent, the North-western States with its famed duck ponds, Lake Champlain in its palmy days, the famous Longue Point and Sorel marshes, seal reef in the St. Lawrence and the Labrador shore with its myriads of birds; but never have I seen anything that could compare to this Hudson Bay shore. Geese of various kinds, black and pintail ducks, many species of plovers and the smaller members of this family, are to be found there in countless thousands. All that low marshy belt of land extending from Churchill to James bay, several hundred miles in length and eight to ten wide, on

an average, is nothing but an immense breeding ground."¹

MINERAL RESOURCES.—Canada began to realize the previously unsuspected value of her northern mineral resources in 1896, when the production of gold in the Yukon district leaped from a value of three hundred thousand to two and a half million dollars in a single year. A year later the gold output of the Yukon country had increased to ten million dollars. The wealth of the Klondike river permanently dissipated the scepticism which once reigned concerning the potential value of Canada's mineral resources in high latitudes. The work of the Canadian Geological Survey has assembled a very large amount of detailed information concerning these resources, many of which remain undeveloped chiefly because of the vast distances involved and the entire absence of population in many of the areas in which they occur. In the space here available only the briefest mention of some of these resources is possible.

It may be pointed out, however, that the solution of the problem of placing certain of our railways on a paying basis depends more completely on the development of our mineral resources than on the growth of any other industry. This fact is well illustrated by the financial record of the White Pass and Yukon Railway, the most northerly railway in Canada, which was built soon after the discovery of the Klondike. The net earnings of this road during the first year of its operation were reported as \$30,000 a mile, and for the fiscal year ending in 1902 as 61 per cent of the capital stock.

Copper, because of its coloured salts, is much more easily recognized than either gold or silver. It has been found at various points in the Northwest. Tyrrell has reported it from the northwest side of Hudson bay between Bakers Foreland and Cape Eskimo in Keewatin greenstone. J. M. Bell speaks of numerous stringers of calc spar containing chalcopyrite east of McTavish bay, Great Slave lake. On the White and Copper rivers near the Yukon-Alaska boundary native copper occurs loose in the gravel of the river bed. Undoubtedly the largest area of copper mineralization in Canada is that extending along the Arctic coast from the Coppermine river eastward to Bathurst inlet.

The existence of these extensive deposits of native copper has been known for more than a hundred years. A recently published report on them gives some important information concern-

¹ Hewitt, C. Gordon: *Op. cit.*, p. 317.

¹ Dept. of the Naval Service: Reports on Fisheries Investigations in Hudson and James Bays and Tributary Waters in 1914, pp. 77, 78, 1915.



FIG. 27. THE OLD AND NEW METHODS OF TRANSPORT IN THE NORTH.

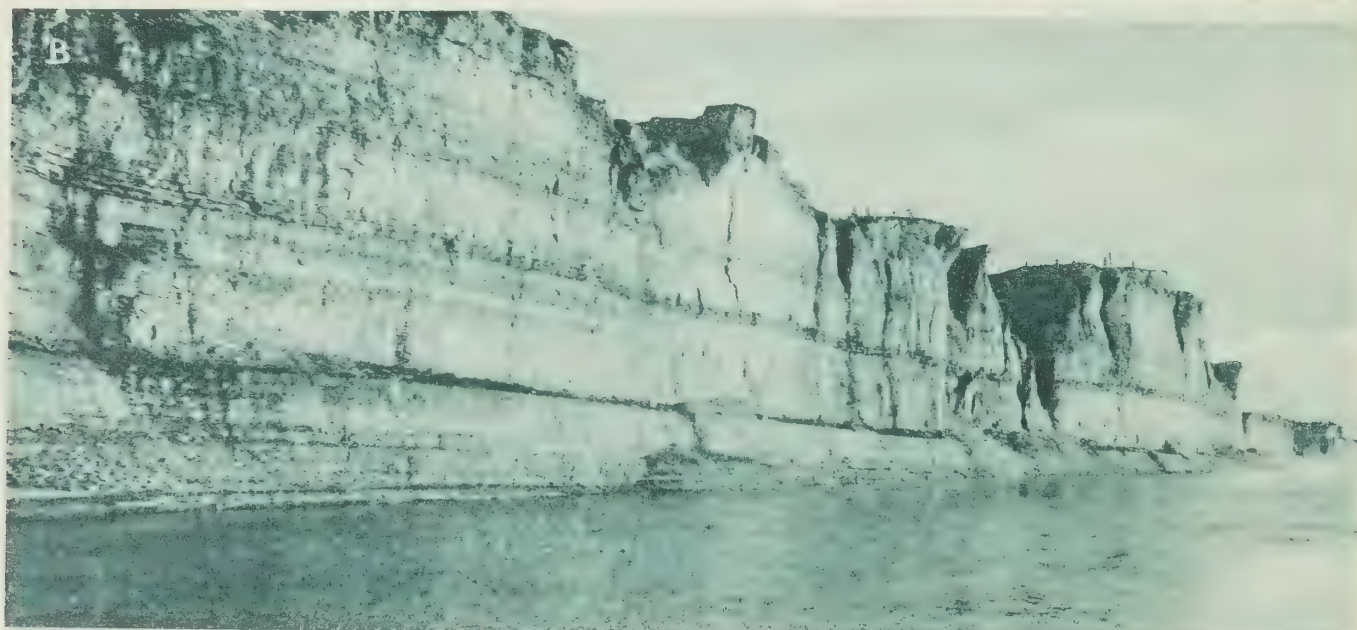
A. FIRST AIRPLANE TO REACH MACKENZIE RIVER, IN 1921. PHOTOGRAPHED AT PROVIDENCE BY MR. KITSON.

B. CATERPILLAR TRACTOR PORTAGING AROUND SMITH RAPIDS, SLAVE RIVER.

A



B



C



FIG. 28. A. ALEXANDRA FALLS, HAY RIVER, HEIGHT 105 FEET.
B. RAMPARTS OF MACKENZIE RIVER.
C. FALLS $1\frac{1}{2}$ MILES BELOW ALEXANDRA FALLS.

ing the extent of Canada's resources in the North. Professor O'Neill states, with reference to the Bathurst Inlet area (See Map, Fig. 2) on the Arctic coast, that "native copper was seen on almost every island in the area as well as on the mainland. The distribution of the metal is remarkably uniform throughout any single flow. A rock section over 450 feet thick, on Banks peninsula, showed copper through about 350 feet of the total thickness. *Disseminated copper occurs over the whole area of more than 1,000 square miles and practically through the whole exposed thickness of the formation.* In addition to native copper, sulphides of copper occur in the district and appear to be worthy of investigation. The possibility should not be forgotten that, in the Coppermine River region, important deposits of sulphides may also occur in the limestones or dolomites, which are there found below the amygdaloids. Some of the thin dolomite layers are completely replaced for several feet along the strike and others have masses of the sulphides scattered through them. The determination of the sulphide content with reasonable degree of accuracy would at least involve drilling. The sulphides of one layer, 6 inches in thickness, were examined by H. E. Ellsworth, and determined to be a mixture of 79 per cent chalcocite and 21 per cent covellite, and on analysis the material proved to contain 49.87 per cent copper. Assuming that one cubic yard of rock weighs 1 ton and that 90 feet is the average thickness of copper-bearing rock, the available tonnage would be about 6,000,000,000 tons carrying 1/100 to 1/4 of one per cent of disseminated native copper; and an unestimated amount of amygdaloidal material, which assays over one per cent of copper; as well as the copper of the veins, some of which are filled with thin sheets of native copper and others carry over 4½ per cent of flake copper."¹

Concerning the Coppermine River district O'Neill writes as follows: "It is also certain that the matrix of some of the conglomerates has been replaced by native copper, and a specimen obtained of this is very rich. It is also known that numerous large masses of copper occur in the drift immediately north of the copper-bearing rocks west of Coppermine river; so that it seems highly probable that parts of this district contain workable and even rich deposits. The district is easily reached from Great Bear lake and transportation could be arranged via the Mackenzie River valley."²

The transportation problem which must be solved when these copper deposits are developed is discussed under the head of Oceanography and Marine Transportation.

The presence of oil in the Mackenzie River valley has long been known, but the remoteness of the region from markets has delayed until recently any attempt to develop it. The tar springs of the Athabaska region were noted as early as 1789 by Sir Alexander Mackenzie in the *Voyages through North America to the Frozen and Pacific Oceans*. The first report of the Canadian Geological Survey on the Mackenzie River valley by McConnell published in 1890 describes the oil prospects of the region. His report states that "the Devonian rocks throughout the Mackenzie valley are nearly everywhere more or less petroliferous, and over large areas afford promising indications of the presence of oil in workable quantities. The rock is in several places around the western arm of Great Slave lake highly charged with bituminous matter and on the north shore tar exudes from the surface and forms springs and pools at several points."³ Nearly every geologist who has since visited the region has commented on the oil seepages found in certain areas. The discovery of oil in the Mackenzie valley is therefore not a new thing.

The first attempt to exploit this oil was made during the summer of 1920 by the Imperial Oil Company. At 783 feet a strong flow of oil was struck. For ten minutes a column of oil spouted from the 6-inch casing to a height of 75 feet above the derrick floor, after which the well was capped. The flow on that occasion probably exceeded 600 barrels of oil. On two subsequent occasions the valve was opened, with similar results. This well was eventually deepened to 951 feet and another flow of oil struck amounting to 60 or 70 barrels per day. The transportation problem has prevented the development of Mackenzie Valley oil beyond this demonstration of its existence in what would be good commercial quantities further south.

Natural gas was encountered while drilling for oil north of Norman and used for heating purposes by the drillers throughout one winter. The presence of a gas field on the Athabaska river was demonstrated several years ago by the Pelican well which remained for a long period uncapped because of the high pressure and volume of the gas flow. Utilization of the gas of the Mackenzie basin must await with the oil the growth of population northward or the

¹ O'Neill, J. J.: Canadian Arctic Expedition, 1913-1918, vol. XI, Geology and Geography, pp. 51A-62A, 1924.

² O'Neill, J. J.: *Op. cit.*, p. 71A.

³ McConnell, R. G.: On Exploration in the Yukon and Mackenzie Basins, N.W.T., Can., Can. Geol. Surv. Ann. Rept. N.S. vol. IV, pt. D, page 31, 1888-89 (1890).

development of a means of marketing which will solve the problem of transportation to centres of population.

The occurrence of hematite iron ore in the Mackenzie valley has been reported at two widely separated points by Keele¹ and the author.² It is important to note that this area is not very remote from a deposit of coal in the form of lignite which occurs near Norman in a bed about 5 feet thick. This coal was discovered by Mackenzie more than a hundred years ago, at the time of his journey down the great river. Ignited through some unknown agency it was burning then and was still burning when seen by the writer in 1919. Coal has been reported on the Liard river, on the north shore of Great Bear lake and elsewhere in the north.

The salt used in the Mackenzie valley has been supplied since the earliest days of the fur trade by the natural deposits on the Salt river west of Fort Smith and other similar localities on the Athabaska river where brine springs produce considerable annual deposits of salt.

The problem of utilizing the rich asphaltum deposits of the bituminous sands which border the Athabaska river for more than a hundred miles is one of the many problems of economic geology in the North still awaiting solution. The bituminous sand is a soft, porous sandstone saturated with a thick black oil resembling and smelling like asphaltum. On a warm day much of this material easily moulds into balls in the hands. It has been utilized to a limited extent in road building.

Too little is known of the Precambrian Shield (Fig. 22) south of the coastal strip along the Arctic sea to say anything of its mineral resources except to point out that the formations which have furnished the rich silver and nickel ores of Ontario are likely to be found in this region. J. B. Tyrrell, who traversed and mapped parts of this region some years ago for the Canadian Geological Survey, has expressed his confidence in the future development of mining in the Barren Lands as follows:³ "That these belts of Huronian rocks will eventually prove of great economic importance, there can be no doubt whatever. In Ontario the wonderful general richness of these rocks is just beginning to be recognized, but from them were taken in 1896 gold to the value of \$121,000, nickel to the value of \$1,189,000,

and copper to the value of \$320,000; while in the states adjoining Lake Superior the total production of iron ore in 1895 from these rocks was 10,269,000 long tons, valued at about \$20,000,000. This was 62.31 per cent of the total amount of iron produced in the whole United States." The confidence thus expressed by Tyrrell a quarter of a century ago, in the future great developments to be expected in the Huronian rocks of the northern parts of the Canadian Shield, has been amply justified by the discoveries of recent years in the rocks south and southeast of the Barren Lands. The story of the discovery of the Flin Flon area in Manitoba with its gold, copper, and zinc deposits; of the Red Lake mines in northern Ontario, and of the Rouyn district in Quebec reads like a fairy tale. Even during the year 1927 when no spectacular mining discoveries were made in Canada, the total value of the mineral production was \$241,773,000—a gain of one and one-third million dollars over the previous year's record.

WATERPOWER.—In the vast area of the Canadian Shield (Fig. 22) where important mining developments may be expected in the future, coal is absent but an abundance of hydro-electric power is available. The Nelson river affords a conspicuous example of unused power. According to the late Dr. Wm. McInnes¹ the Nelson river has a descent of about 240 feet between Winnipeg and Split lakes. The current between the numerous lake expansions is generally swift, and upwards of a dozen falls and rapids occur, some of the former offering magnificent sites for waterpowers. The aggregate power that could be generated along the river is enormous, as the amount of water passing over the various falls is very great. The volume of the river can be appreciated by a consideration of the extent of its drainage area, which embraces all the country westward to the mountains between the watershed of the Churchill and Athabaska on the north, and the Missouri on the south, and eastward to the head waters of Albany river, and within fifty miles of Lake Superior.

The basin of Great Slave lake is a region which possesses a large amount of potential waterpower. The great Precambrian Plateau rises about 700 feet above the eastern end of Great Slave lake. The Lockhart river descends from this plateau to the lake in a series of rapids and falls, its discharge being more than 20,000 cubic feet per second.² G. H. Blanchet estimates the highest

¹ Keele, Jos.: *A Reconnaissance Across the Mackenzie Mountains on the Pelly, Ross and Gravel Rivers, Yukon and Northwest Territories*: Geol. Surv. Can., 54 pp., 1910.

² Kindle, E. M.: *Notes on the Iron Ores of Mackenzie River Valley*: Geol. Surv. Can., Summ. Rept., pt. C., pp. 1c-2c, 1919.

³ Tyrrell, J. B.: *Natural Resources of the Barren Lands of Canada*, *Scottish Geographical Magazine*, vol. XV, p. 134, 1899.

¹ McInnes, Wm.: "The Basins of Nelson and Churchill Rivers", Geol. Surv. Mem. No. 30.

² G. H. Blanchet: *An Exploration into the Northern Plains North and East of Great Slave Lake, etc.* *Can. Nat.*, vol. 38, p. 186, 1924.

of these falls to have a drop of about 100 feet.¹ He states that "from the portion of the river seen it was decided that as a power proposition it is almost unrivalled, but it is unnavigable." The southwestern side of Great Slave lake is rimmed by a limestone scarp comparable with the one over which the Niagara river drops to the Ontario lowland. The Hay river in crossing this scarp forms the Alexandra falls with a drop of 105 feet and a second lower fall below it (See Fig. 27). The Alexandra falls are located 40 miles from the lake at the northern margin of a great unoccupied grazing region.

Various other great undeveloped sources of power in northern Canada could be mentioned. Among them are the rapids of the Great Bear river, where this stream crosses the Franklin mountains, and Bloody falls on the Coppermine river.

There is perhaps no other phase of economic development in which such rapid strides are now being made as in the utilization of hydro-electric power. Although Canada has not yet begun to develop this power north of 56° she greatly outranks in her developed power every country in Europe. Developed Canadian power is twice that of Italy, her nearest European rival, and exceeds the combined hydro-electrical power development of South America, Asia and Africa by 1,692,000 horsepower according to a recent press bulletin of the United States Geological Survey. These comparative figures have real significance when it is understood that the great reserves of power in the northern half of the country are still untouched and only a beginning has been made in utilizing Canada's "white coal."

THE ARCTIC ISLANDS

A vast area of unexplored lands is represented by the large islands north of the Arctic coast of Canada. The approximate position and coastline of most of these islands was determined by the various expeditions which were so long engaged in searching for a "northwest passage" to the Orient. Various scientific expeditions including the Canadian Arctic Expedition, have contributed to the extension of knowledge of parts of the coastal zone of some of them. Concerning Baffin island, the most accessible of the Arctic islands, which is about one thousand miles long and from one hundred to four hundred miles wide, we have only a very limited knowledge, although the first attempt to mine the precious metals in North America was made there. Ellesmere island, the most northerly of the Arctic

islands, is better known, as a result of the work of Norwegian and other scientific expeditions, than any other of the large islands. In Bylot island the Fifth Thule Expedition^{1a} found "sandstone and clay alternating with beds of coal", about 50 bags of coal being used every year. Both the McMillan and Sverdrup expeditions report thick beds of coal on Ellesmere island. Both coal and copper are known to occur in the southern part of Victoria island.

The Arctic islands, although in the same latitude as Greenland, are not covered by ice caps as that great island is. A rather light snowfall appears to characterize the parts of the Arctic archipelago which are best known. Stefansson states that 75 to 90 per cent of the surface of Arctic lands is nearly free of snow at all seasons, since the little that falls is swept into the lee of the hills. One of the Northwest Mounted Police patrols, in going from Chesterfield inlet to the Arctic coast, found some difficulty in keeping to a route with sufficient snow for their sleds.

J. G. McMillan, who wintered on Melville island in 1909, notes that "caterpillars were observed crawling about on the ground in sheltered places" a few days after May 10th.¹

Concerning the summer climate of the Far North we have statements such as the following from Sverdrup which refers to the summer weather in Ellesmere island, the most northerly island yet discovered:—"The sun now (July 3) burnt just as it does on the Norwegian mountains on a really hot summer day."²

Most, if not all, of the Arctic islands are the grazing grounds of caribou and polar cattle or musk-oxen. Stefansson's description of the summer landscape in one of these islands may be quoted here as representative of a large share of these Arctic grazing lands. "The hunting and exploring trip into the interior of Banks island was an interesting and delightful one for Storckerson and me. Here was a beautiful country of valleys everywhere gold and white with flowers or green with grass or mingled green and brown with grass and lichens, except some of the hill tops which were rocky and barren. These hills differed in colouring, especially as seen from a distance, not so much because of the colours of the rock as because different vegetation prevails in different kinds of soil and different lichens on different rocks. There were sparkling brooks that united into rivers of crystal clearness, flowing

^{1a} P. Frenchen and T. Mathiassen. *Geog. Review*, Vol. 15, 1927, p. 252.

¹ Bernier, J. E.: Report of the Dominion of Canada Government Expedition to the Arctic Islands and Hudson Strait on board the D.G.S. *Arctic*, p. 407, 1910.

² Sverdrup, Otto: *New Land*, vol. 1, p. 185, 1904.

¹ *Ibid*, p. 187.

over gravel bottoms.”¹ . . . “The winter snowfall is far less than in such countries as Montana, where stock feed out all winter.”² All the information available concerning the indigenous fauna and the vegetation of the Arctic islands indicates that considerable portions of them may be classed as grazing lands. On these the domestic reindeer would undoubtedly thrive and support as large a population as it does near the Arctic shores of Europe.

The future development of aerial navigation will give to this part of Canada a practical interest and value which it does not yet possess. Arctic ice floes form an effective bar to marine navigation on a commercial basis among the Arctic islands, but aerial navigation over an ice-blocked sea is safer than over an ice-free sea. Man’s conquest of the air will enable him to take advantage of the principle of what is called great circle sailing. To go west or go east from many points in the northern hemisphere, the shortest way will be to fly north over the Arctic islands. With the perfection of aerial navigation it will become an absurdity for anyone going from England to Japan to travel by way of New York or Montreal. They will, if they wish to go by the most direct route, fly over the Greenland sea and the Arctic islands.

Stefansson makes the surprising observation concerning one of the new islands discovered by him, that he saw there, in a whole summer, only one mosquito. The uniqueness of a mosquito-less island in the Arctic sea can be best appreciated by experienced Arctic travellers who know the wide distribution of this pest. If Loughheed island remains undiscovered by the mosquito it should become immensely popular as a summer resort in the future when the liners of the air have made the farthest Arctic islands more accessible to southern Canada than Florida is today.

FISHERIES

John Cabot’s report on his return to Europe from the Labrador coast in 1497 concerning the shoals of cod which he declared to be so numerous that “they sumtymes stayed his ships”, resulted in all the countries of western Europe sending fishermen to the new fishing grounds, which have been exploited with abundant success down to the present.

The lakes, rivers, and small streams of the Northland are nearly everywhere abundantly supplied with fish. The vast number of lakes in northern Canada provide almost unlimited pos-

sibilities for the future development of inland fisheries. In all parts of the North large quantities of fish are cured in summer, usually by drying, for the use of men and dogs in winter. Dogs are fed almost exclusively on fish.

The great importance of fish to the northern Indian is illustrated by one of Sir Alexander Mackenzie’s stories. An Indian chief, near the Pacific, was informed by Mackenzie that Great Britain owned the sea, and if he failed to treat him well he would inform his King, who would stop the salmon from ascending the rivers. The intimidation produced the desired effect.

The Yukon river and its tributary streams have, throughout the summer season, an abundance of salmon which supplies a considerable portion of the food of prospectors and others living near the larger streams. In various places along the Yukon where the current is strong, ingeniously constructed water-wheels are placed, to the paddles of which are attached boxes set at such an angle as to pick up the salmon as they bump into the wheel in ascending the river and spill them into a boat moved alongside. This ingenious arrangement relieves the prospector of all the ordinary labour of fishing and leaves him only the work of cutting up and drying the fish for the use of himself and dogs in winter. The Pacific Coast salmon is not known in the Mackenzie basin, if one or two rare catches be excepted. A wealth of fish, however, is found both in the rivers of the Mackenzie basin and in the large lakes connected with them.

The fisheries of Great Slave lake have long possessed considerable commercial importance to the people of the region. McConnell reports that about 40,000 fish were cured at the Big Island fishery near the western end of Great Slave lake during the season of his Mackenzie river journey. Fish of various kinds are taken with nets and hooks in Great Slave lake throughout the year. But the bulk of the fishing in this lake is done between the 20th of September and the 10th of October when fish are especially abundant at certain localities and the approach of cold weather makes preserving them easy and certain. The most abundant and valuable fish in Great Slave lake is the white-fish, (*Coregonus clupeiformis*), which is widely distributed throughout the northern rivers and lakes. This fish, in the western part of the lake, averages about three pounds in weight. With it is associated the lake trout, (*Salvelinus namaycush*), which sometimes weighs more than 30 pounds, and the inconnu (*Stenodus mackenzii*). The greyling, pike and various other species occur in abundance in the North. Ac-

¹. Stefansson, V.: “The Friendly Arctic,” MacMillan Co., p. 247, 1922.

². Stefansson, V.: *Op. cit.*, p. 585.

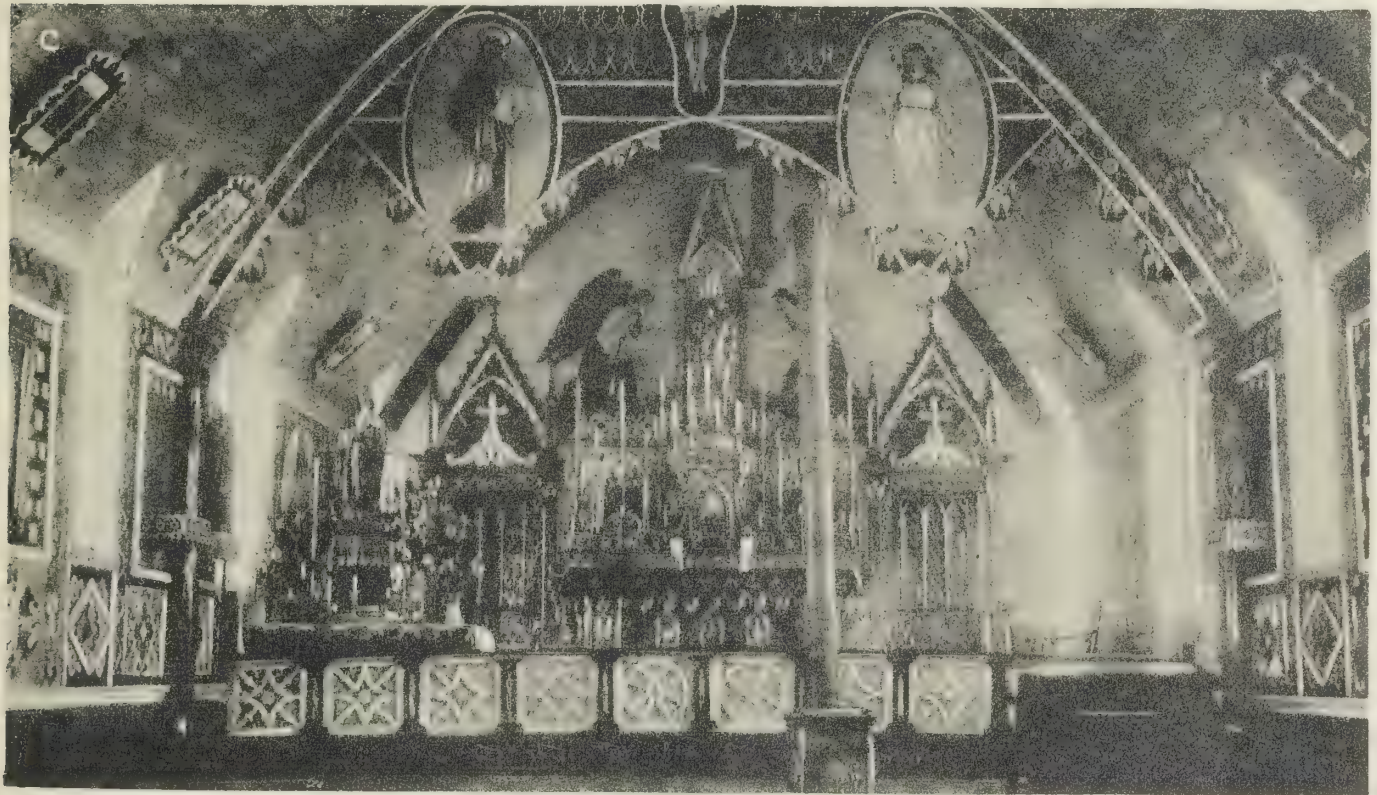


FIG. 30. A. THE STEAMBOAT *Mackenzie River*.

B. BAKING ON A STONE OVEN.

C. INTERIOR OF A ROMAN CATHOLIC CHURCH AT FORT GOOD HOPE, MACKENZIE RIVER, NEAR THE ARCTIC CIRCLE.

D. A HALF-BREED WOMAN AT NORMAN, MACKENZIE RIVER.

E. INDIAN BOY AND GIRL AT NORMAN.

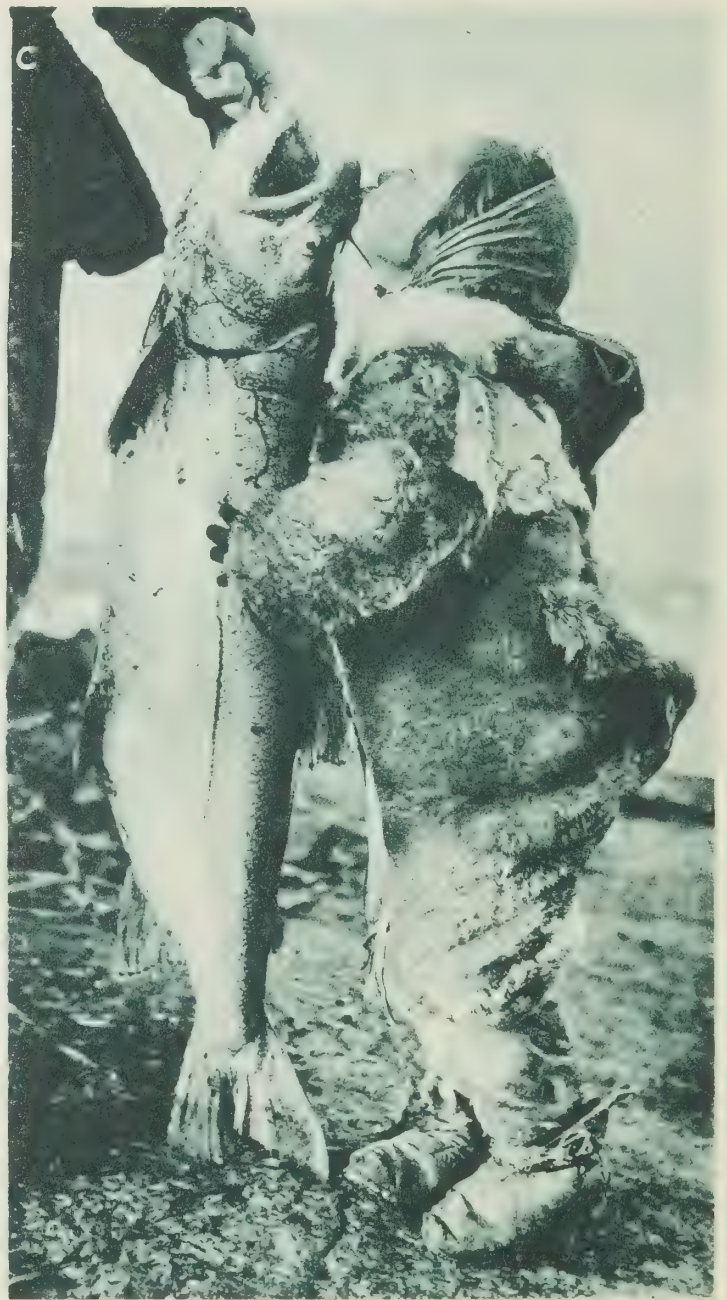


FIG. 29. A. THE END OF A PERFECT DAY SOMEWHERE IN THE NORTH.
 B. A PHOTOGRAPHER-FISHERMAN, HAY RIVER, GREAT SLAVE LAKE.
 C. TROUT TAKEN AT POINT EPWORTH, ARCTIC COAST OF CANADA.

according to O'Neill¹, in the region near the Arctic coast "fish may be obtained in large quantities in most of the rivers at certain seasons and in the larger lakes all the year around." Everywhere in the North fish is the great staple of the country which stands between the native races and starvation when other food supplies fail, though the Arctic coast seal meat largely replaces fish in supplying winter food for dogs.

The investigations of the naturalists of the Department of the Naval Service indicate that Hudson bay possesses large potential resources in its undeveloped fisheries. The Greenland codfish is found on the eastern coast of Hudson bay as far south as Eastmain river. C. D. Melville states that "there can be little doubt that the whitefish industry of James bay will prove to be one of the most prolific in Canada, equalling, if not surpassing, the fisheries of the Great Lakes." Little is known of the fish on the west coast north of the Churchill. Nap. A. Comeau investigated the fishery problem of the coast near the Nelson river and reported that "during the time I was on the Nelson, especially on my last trip in September, we could easily, had we devoted our time to it, have taken with our short seine, from eight hundred to a thousand pounds of fish daily. In one single haul we caught 689 whitefish. On the Hayes river, near Fishing island, a haul of 100 fish is frequently made. Even at a moderate price, this would be quite a lucrative business, provided it could be shipped fresh to market, as will be the case in a year or two. Some experiments that we made in salting a few proved very satisfactory."²

Tyrrell testifies to the quality of the fish of Hudson bay in the following words:³ "Salmon of the very finest quality are found in abundance both in Hudson bay and strait. I have several times procured them from Eskimos and can testify as to their superior quality". Both Hanbury and Richardson report a trout in the rivers of the Arctic coast closely resembling the sea trout of England.⁴ The abundance of fish at certain points in Arctic Canada is shown by one of Hearne's⁵ stories. On the Coppermine river "he saw an old woman, almost blind, sitting by the side of the water, killing salmon which lay at the foot of the fall as thick as a shoal of herrings. Their numbers at this place were almost incredible, perhaps equal to anything that is

related of the salmon in Kamschatka, or any other part of the world."

It is quite possible that the abundant fish of our Arctic coast may eventually be used by some of their future inhabitants for the winter food of domestic animals just as sea food is now used on the Arctic coast of Russia for cattle and swine. E. Reches¹ states that on the south coast of the White sea in Arctic Russia "the cattle and swine are mostly fed on red herrings" which "swarm in such quantities that they may at times be taken in bucketfuls." The photograph (Fig. 29C) shows an Arctic coast trout.

It is a generally recognized principle of marine biology that the abundance of life in the sea increases regularly in passing from the tropical to the polar regions. The abundance of marine fishes may therefore be expected to increase rather than decrease north of the long exploited cod fisheries of the eastern coast of Labrador. The distance from markets is the chief bar to developing fisheries far north of the Labrador fisheries.

A number of whaling vessels have for many years been engaged in whale fishing in Beaufort Sea off the northern coast of Canada. Whaling stations have been operated at a few points adjacent to Hudson bay. The profits under favourable conditions, of one cruise of a small whaler are suggested by the following extract from Inspector G. L. Anderson's report dated Ft. Macpherson Feb. 16, 1910. "The *Karluk* cruised in the neighbourhood of Baillie island and Banks island on September 23, having killed eleven bowhead whales, eight of which I understand were taken in Canadian waters, north and east of Cape Parry. The value of this cargo of eleven head, is, by an estimate at the present low price of bone, eighty-five thousand dollars. The *Karluk* is wintering at Herschel island and will return to the eastward by first open water. As she will have the field to herself for at least six weeks before any other ships arrive from the westward, the chances are that she will make another large catch, and will no doubt leave in the fall of this year for San Francisco with a cargo of bone valued from one hundred and fifty thousand dollars upward. The value of the trade of the *Karluk* in pelts will also be several thousand dollars."

OCEANOGRAPHY AND MARINE TRANSPORTATION

North of Alaska and the western part of the Canadian Arctic coast the continental shelf has considerable width. The shoaling of sea

¹ O'Neill, J. J.: Canadian Arctic Expedition, 1913-1918, vol. XI, Geology and Geography, p. 73A, 1924.

² Dept. of Naval Service, Reports on Fisheries Investigations in Hudson and James Bays and Tributary Waters in 1914, p. 77, 1915.

³ Tyrrell, J. B.: Through the Sub-Arctic of Canada.

⁴ Hanbury: Sport and Travel in Northern Canada.

⁵ See "The Unexploited West", p. 347, 1914.

¹ Elsie Reches: The Earth and its Inhabitants, vol. 5, p. 355.

begins far from land which results in the absence of good harbours west of Herschel island. The shallow sea and scarcity of harbours, combined with the presence throughout the summer of the ice pack at variable distances from the coast, make navigation around Alaska to the Arctic coast of Canada impracticable except for vessels like the whalers which are prepared to winter on the coast. Various explorers have shown the uncertainty and difficulty of navigating the narrow inter-island channels northwest of Baffin island owing to floe ice.

A characteristic feature of Hudson bay is its relative shallowness. Very few soundings in the deepest parts exceed 125 fathoms and none of them equal the depths found in some of the narrow inlets and fiord-like waterways on the eastern side of the Labrador peninsula. Around the southern end of James bay and the southwestern side of Hudson bay the seaward slope of the sea bottom is only two or three feet per mile for long distances from shore. This shallow coast makes the difficulties to be overcome in developing sea port approaches to Moose Factory, Nelson, and other points on this coast very great and quite comparable with those encountered in making a sea port of Buenos Aires. Along the northern part of the western shore of Hudson bay, however, the shallow coast gives way to relatively deep water. Whereas the charts show a depth of only $2\frac{1}{2}$ to 6 fathoms at the mouth of the Nelson river, the entrance to Chesterfield inlet has 20 fathoms, increasing to 30 fathoms at 100 miles distance from the sea. This inlet, which can be ascended to its head by ocean-going steamers, is open for three months in the year. From its head it is only 580 miles to the Copper mountains west of Coppermine river over a gently undulating country.

It may be pointed out here that the distance by sea from Chesterfield inlet to Liverpool is less than the distance from New York city to Liverpool. This is a fact of vital importance in connection with the future development of reindeer herding in the Arctic Prairies which border the western side of Hudson bay. It is equally important with reference to the future development and utilization of the Coppermine River and Bathurst Inlet copper deposits, which appear to be among the most extensive deposits of native copper in the world. Bathurst Inlet copper could be shipped to any Atlantic seaboard city by an all sea route except for 125 miles across the peninsula between Chantrey inlet on the Arctic coast and Wager bay on the northwest coast of Hudson bay. The construction of a motor road or railway across this peninsula may be

shown by future investigations of the geography and hydrography of the base of the Melville peninsula to be the most economical method of getting these ores to market.

Port Churchill, at the southeastern extremity of the Barren Lands, is generally open five months of the year, June 19 to November 18, the shortest season known being four months and eight days, and the longest five months and eighteen days.¹

The navigation of Hudson bay is limited by the prevalence of ice floes to the summer and early autumn months. The length of the period during which navigation is possible and reasonably safe will doubtless vary in different years as it does elsewhere in the northern seas. The late Mr. W. A. Bowden, formerly Chief Engineer, Department of Railways and Canals, has been quoted concerning the relative hazard of navigation in Hudson bay as follows: "Navigation to Port Nelson is as safe as to Montreal. An unprotected steamer had no difficulty in making the straits, leaving Port Nelson on October 22nd. This was an ordinary single-decked tramp steamer without any ice strengthening whatever, 290 feet long, 3400 tons, named the *Sheba*. I purposely did not strengthen the three ships which we purchased—the *Sheba*, the *Sharon*, and the *Durley Chine*. I decided that it was desirable in the interests of the project as a whole to know what an ordinary vessel could do. These vessels made a number of voyages to the Bay without any trouble, going early and coming late."

Some idea of the probable future value to Canada of sub-Arctic sea ports may be gained by referring to the port of Archangel which had at the time of the 1917 revolution a population of about 42,500. This Russian sea port located on an arm of the Arctic Ocean within 2° of the Arctic Circle affords a striking example of an Arctic port which has played a most important rôle in the commercial development of north-eastern Europe. For nearly a century and a half previous to the construction of St. Petersburg, Archangel was the only mart of the Russian import and export trade. Although closed by ice six months in the year the importance of this Arctic port to Russia was emphasized as it had never been before at the beginning of the World War when all of her other ports were closed.

The short sea route to Europe commanded by ports on the western side of Hudson bay, and their relation to the shipment of western grain and the mining products which may be expected from the Precambrian belt of the Northwest

¹ Tyrrell, J. B.: The Natural Resources of the Barren Lands of Canada. *Scottish Geographical Magazine*, vol. XV, p. 137, 1899.

Territories, give them a strategic position comparable with that which Archangel holds with respect to northern Europe.

SETTLEMENT

If the growth of population in all parts of Canada is a desirable thing, there is no part of the Northland which needs more to be brought to the notice of the public than the Arctic coast and the region northwest of Hudson bay. If it can be demonstrated that large settlements of the white race can live in that region as contentedly and happily as the Eskimo do, the vacant lands to the south will fill up fast enough to put our frontier railroads on a paying basis at an early date.

Professor O'Neill, after describing the climate of the Arctic coast, where he spent two winters, writes:¹ "It may be seen, then, that as far as the climate is concerned, there is nothing to prohibit settlement. Game and fish abound and there should be little difficulty in establishing a mining industry if the mineral deposits prove to be valuable. Underground mining could be carried on throughout the whole year without much inconvenience."

The lowest temperature recorded during his second winter on the coast was -44° . The minimum temperature for the same season (1915-1916) at Edmonton was -45° . Conditions which appear to decidedly encourage settlement on the Arctic coast are stated by Professor O'Neill as follows: "The sun is quite hot in April, the seals come out on the ice and the caribou begin their migration to the northern islands. In May, the wild-fowl arrive and after them the small birds; the sun shines for twenty-four hours and the vegetation responds rapidly, so that by the middle of June many wild flowers are in bloom, the slopes and the valleys are green and small animals are seen everywhere."

"Waterpower in abundance for mining operations and probably enough to take care of local transportation, is available from Coppermine, Tree and Hood rivers. Coppermine river, at Bloody falls, is sometimes open all winter."¹

The ground is free of snow for three or four months in the year. Timber for building purposes is available at various points in the river valleys near the coast. Driftwood is common at many points on the coast. Coal is available in two or more of the adjacent Arctic islands on Horton river and elsewhere inland.

All of the evidence indicates the Arctic coast of

Canada to possess a climate subject to fewer extremes of temperature than northern Ontario or the Prairie Provinces. Summer frosts may be expected, but they are by no means unknown or even rare in the country between Sudbury and Porcupine, a region long ago demonstrated to be suitable for agriculture.

Anyone unfamiliar with Anglo-Saxon conservatism might suppose that the publication of such convincing testimony as that cited above concerning the habitability of the Arctic coast of Canada would promptly start a stream of emigrants toward the north coast. But most Canadians have read yarns about the terrors of the Arctic for too many years to believe the truth when it is given them.

The people of the central United States have so long endured the terrific summer heat of the interior of the continent that they consider it one of the necessary and unavoidable hardships of an agricultural country. In the malarial belt of the United States the certainty of perfect health with the possibility of wealth in the north and complete immunity from malaria would probably be outweighed by the widespread belief in the impossibility of comfortable living within the Arctic Circle.

It is useless to tell the English or the French about a country where the continuous summer thawing of the sub-soil furnishes moisture to vegetation as it is needed with a certainty and uniformity unknown in southern latitudes and where twenty-four hours of sunshine in June nearly doubles the rapidity of growth known in the south. Like the Man from Missouri he must be shown and the way to show him is to encourage emigrants from the northern part of the Scandinavian peninsula and Iceland to begin the development of Arctic Canada.

However encouraging reports concerning the climate, fisheries, minerals and grazing conditions may be, settlement of the Canadian Arctic will be long delayed unless the first settlers are introduced from other Arctic lands. Settlers from northern Norway, Sweden and Finland would be almost certain to make contented and successful colonists in the Canadian Arctic because they would find a climate and environment nearly identical with those to which generations of their ancestors have been accustomed. The introduction and development of reindeer herding may be regarded as an important and necessary feature of the settlement of parts of northern Canada.

The northerly limit of settlement in Canada need not be and will not be dependent on the climatic limitations of agriculture any more than

¹ O'Neill, J. J.: Canadian Arctic Expedition, 1913-1918, vol. XI, Geology and Geography, p. 72A, 1924.

it is in Norway. North of Trondhjem in Norway, located near latitude 63° , as the land becomes hostile to cultivation the people turn to the sea for their living. Even the farmers there live largely on fish and when root crops fail or prove inadequate, the cattle are made to accommodate themselves to fish offal.¹ The coastal strip of Norway as far north as Hemmersfest in latitude 71° has a population of 120 people for each linear mile.² These facts afford some intimation of the large population which the vast sea-coast line of Arctic Canada could, and at some time will, support.

The lure of gold in the Yukon basin will probably result in many additional widely-spaced settlements and mining camps when the prospector has had time to locate the Eldorados which await discovery in the extensive mountain region between the Yukon and Mackenzie River valleys. Perhaps no better method of stimulating and increasing the results of the prospector could be devised than extra-mural courses or extension lecture courses for prospectors by western universities.

Into the vast unoccupied area in northwestern Canada between the Peace and Liard rivers the stockman and farmer will probably move rapidly enough when the opportunities and possibilities offered by the region are widely known. The lowlands around Great Slave lake, the valleys of the Slave river and the Upper Mackenzie will eventually develop as an agricultural region. In eastern Canada the farmer will gradually extend his conquest northward around the shores of James bay.

The Canadian Government has wisely established experimental farms at different points on or near the present northern limit of settlement. In one case—Fort Simpson, in latitude $64^{\circ} 40'$ —the experimental farm is hundreds of miles north of the present agricultural frontier. Some of them, like the Vermilion station on Peace river in latitude $58^{\circ} 30'$, have been maintained long enough to demonstrate just what are the agricultural possibilities and limitations of the region near them. The intending settler should secure from the Canadian Department of Agriculture, in advance of his entry into the region where he contemplates farming, the reports of the experimental station nearest the point where he thinks of locating. From these he will learn to what extent he must modify or change the methods he has practised elsewhere to fit the new climatic and soil conditions to which he must adjust him-

self if success is to be attained. It is also of the utmost importance that he have the precise and detailed information concerning precipitation and other climatic factors which some of these reports contain, for it is to a large extent the climatic factor which determines the kind of crops which should be grown in any region. In eastern Canada the reports of the Kapuskasing station of northern Ontario and in western Canada those of the Beaver Lodge and Vermilion stations will furnish this important information for parts of the northern agricultural frontier.

The settler from the south will find Autumn a most delightful season in James Bay basin and in the basin of the Mackenzie. The birch and poplar of the forests put on the same festive colours which delight the eye farther south in October. In the north, Autumn is ushered in by nightly displays of the Aurora. The magnificence of these celestial pageants of colour, often covering nearly the entire dome of the sky, baffles description. The silent stately movements of the great belts, streamers and pencils of delicately tinted light, give to the northern nights a mysterious and spectacular beauty unknown in southern latitudes. The snow, which follows not far behind the first displays of the Aurora, gives a perfect setting to these gorgeous exhibitions of colour. With the snow come frozen trails and streams and the ease of travel over the icy roads furnished by streams and lakes and the trails hardened by frosts. The emigrant who comes to northern Canada from the Central or Middle Atlantic States or southern Europe will exchange a winter environment of occasionally frozen mud and a bare, drab winter landscape for the cleanliness, healthfulness, and beauty of the White North. Allies of cleanliness and health comparable with the powdery snow and low temperatures which prevail for half the year in northern latitudes are unknown elsewhere. They completely bar from northern Canada malaria, hookworm and numerous other diseases common to southern latitudes. The complete immunity to many germ diseases which the northern climate gives, more than compensates for its winter severity.

CONCLUSION

For three hundred years emigration and civilization in North America have been moving toward the setting sun. During the next hundred years this movement will be as steadily toward the midnight sun as it was towards the sunset throughout the last three centuries. The nearly complete occupation of the good vacant land in the United States and southern Canada has already started this northward movement. Since

¹. Vallaux, Camille: *Geographical Review*, vol. XIV, p. 512, 1924.

². Vallaux, Camille: *Op. cit.*, p. 647.

*Fig. 31*

the "Great West" has filled up, its long-potent lure will yield to that of the Great North. How great a part the development of aerial transportation will play in stimulating the future northward movement of population in Canada cannot yet be clearly foreseen, but that it will be comparable with the influence exercised by railways in peopling the West during the second half of the last century can hardly be doubted (Fig. 28A). The aeroplane and radio may be expected to encourage the settlement of northern Canada in somewhat the same way as the trans-continental railways of an earlier period helped to open the West to civilization.

Northern Canada is a land of great promise. Vast potential agricultural resources, undeveloped fisheries, coal and waterpower in abundance, and most of the useful minerals as well as the precious metals are known to occur there. Anyone who should venture to predict the number of millions who will some day make it their homeland would be accused of unbridled optimism.

We are still, however, in a period when the public gives more credence to unfavourable than to favourable opinions of sub-Arctic Canada. With reference to the possibilities of our northern

empire the average man probably feels somewhat the same uncertainty that the average Englishman felt in the first quarter of the 17th century about the future of the New England colony. The tales of hardship sent back to England by the Plymouth colonists who barely escaped starvation during their first winters in the New World must have sadly shaken the faith of John Bull in the future of a country so desperately cold as New England.

The history of the settlement and development of the Dakotas should be reassuring to anyone who doubts the future of northern Canada. Few parts of Canada can show such an extraordinary combination of obstacles as that which the early settlers had to meet in the blizzard-swept region now known as North and South Dakota. Fifty to sixty years ago wave after wave of emigrants from the eastern states and the north of Europe entered the Dakotas to fight for homes against frost, drought, grasshoppers, and hostile Indians. It is a matter of common knowledge that these pioneers after various campaigns won out and gave to the Union two of its most virile and valuable commonwealths.

Anyone with a sense of humour and some first-

hand knowledge of the country north of 56° will find many of the serious descriptions of it by writers having a limited supply of facts and unlimited imaginations most amusing. The following quotation from Eliot Coues' description of Labrador is an example. "Fogs hang low and heavy over rock-girdled Labrador. Angry waves, palled with rage, exhaust themselves to encroach upon the stern shores, and baffled, sink back howling into the depths. Winds shriek as they course from crag to crag in mad career, till the humble mosses that clothe the rocks crouch lower still in fear, etc."

Coues was a naturalist of real ability but much of his work was done in a quarter of the United States where ice never forms and where rain is about as rare as snow in Florida. If we look up the antecedents of the men who have painted the horrors of an Arctic winter in the darkest colours we are apt to find at least a partial explanation in their previous environment. Kane, one of the explorers of the Arctic archipelago, who had some unpleasant experiences including a thousand-mile drift among the ice-floes, tells us that he was enjoying the sea-shore life in the tropics when orders to join an expedition to the Arctic reached him. Is it any wonder that the hardships of the North have the prominent place in his writings which we might expect sunstroke and torrid heat would have in an Eskimo's description of New York city? In Stefansson we see the effect of an antecedent environment and heredity just the opposite of Kane's. Stefansson is probably telling the real truth when he states that his greatest winter adventure was near his father's barnyard in North Dakota when he became lost during a blizzard and barely escaped freezing. In the Far North he reports having failed, after several years' search, to discover the climatic rigours or the hardships of many previous explorers, but found everywhere the "Friendly Arctic". In giving him this viewpoint toward Arctic Canada, Stefansson's Icelandic ancestry and his boyhood environment in Manitoba and North Dakota are undoubtedly strong factors, but there is not much doubt that it is a far truer and fairer estimate than the one we find in the writings of such authors as Coues and Kane. Other members of the Canadian Arctic Expedition have published little about their observations on Arctic climate but it is a rather significant fact that a member of this expedition who entirely escaped from frost bite during several winters spent in Arctic Canada, froze his ears the first winter after his return to Ottawa.

As a teacher of thrift and industry, Old Jack Frost has no peer. The happy-go-lucky ways of southern climes will not be tolerated in his domains. Those who are diligent in acquiring these fundamentals of a full and useful life are nearly certain to be rewarded with vigorous health, if not with wealth. The certainty of having to provide against occasional winter temperatures of 40° or more below is more effective than any statute in keeping out of northern Canada the mollicoddle and other undesirables. In the virile verse of Service:

*"This is the law of the Yukon and ever she
makes it plain.*

*Send not your foolish and feeble; send me
your strong and your sane."*

A land with a frontier guarded by so searching a critic of immigrants as Jack Frost, must be expected to grow slowly like the oak, and with the same strength of fibre. But it is destined to acquire a population which will eventually be large and show the fine qualities which another northern land implanted in the old Vikings of Norway.

If there are no new continents for these northern Canadians of the future to discover there will be new worlds in science, literature, and the field of human progress awaiting exploration and conquest. The ideas which can "raise men out of the world of corn and money" are the most valuable products of any country. We may expect a land which feeds the imagination and fancy with nightly displays of the Aurora Borealis to mother a race of men who will find pleasure and inspiration in the phenomena of Nature and the northern "sea that bares her bosom to the moon". The Arctic coast of Canada may yet produce poets who

"Have sight of Proteus rising from the sea

Or hear old Triton blow his wreathed horn."

The centres of Canada's industrial and intellectual activity will not remain on the southern border of the country. Science, literature, and the arts can flourish in the northern part of Canada as they do in northern Europe. It was north of 56° in the Old World that Linnæus, the father of modern biology, and that amazing genius, Swedenborg, first saw the light, and we may reasonably expect that the high latitudes of our Dominion will furnish comparable contributions to the future intellectual wealth of the world.

